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Electrical World

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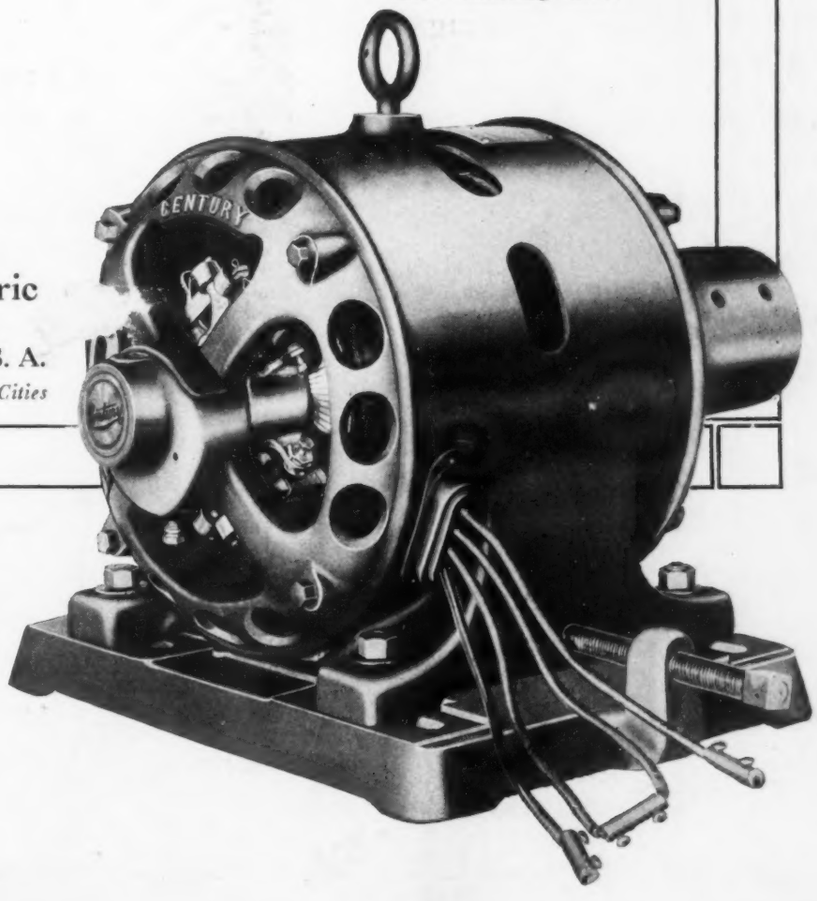

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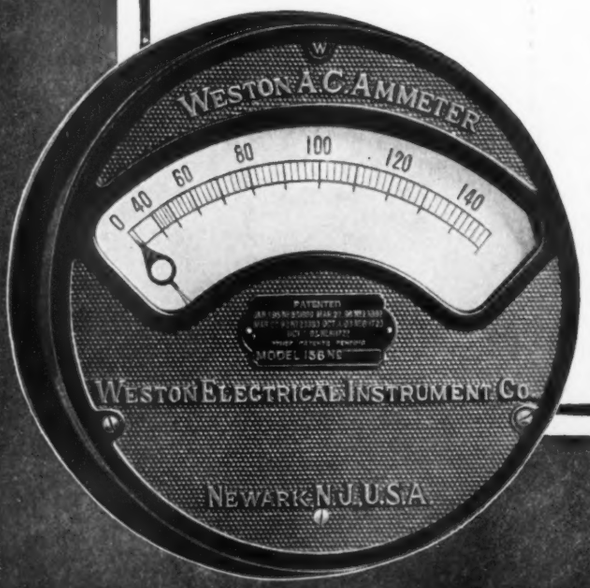

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Electrical World

New York, Saturday, July 23, 1921

The Appliance that Makes the Greatness of Our Industry

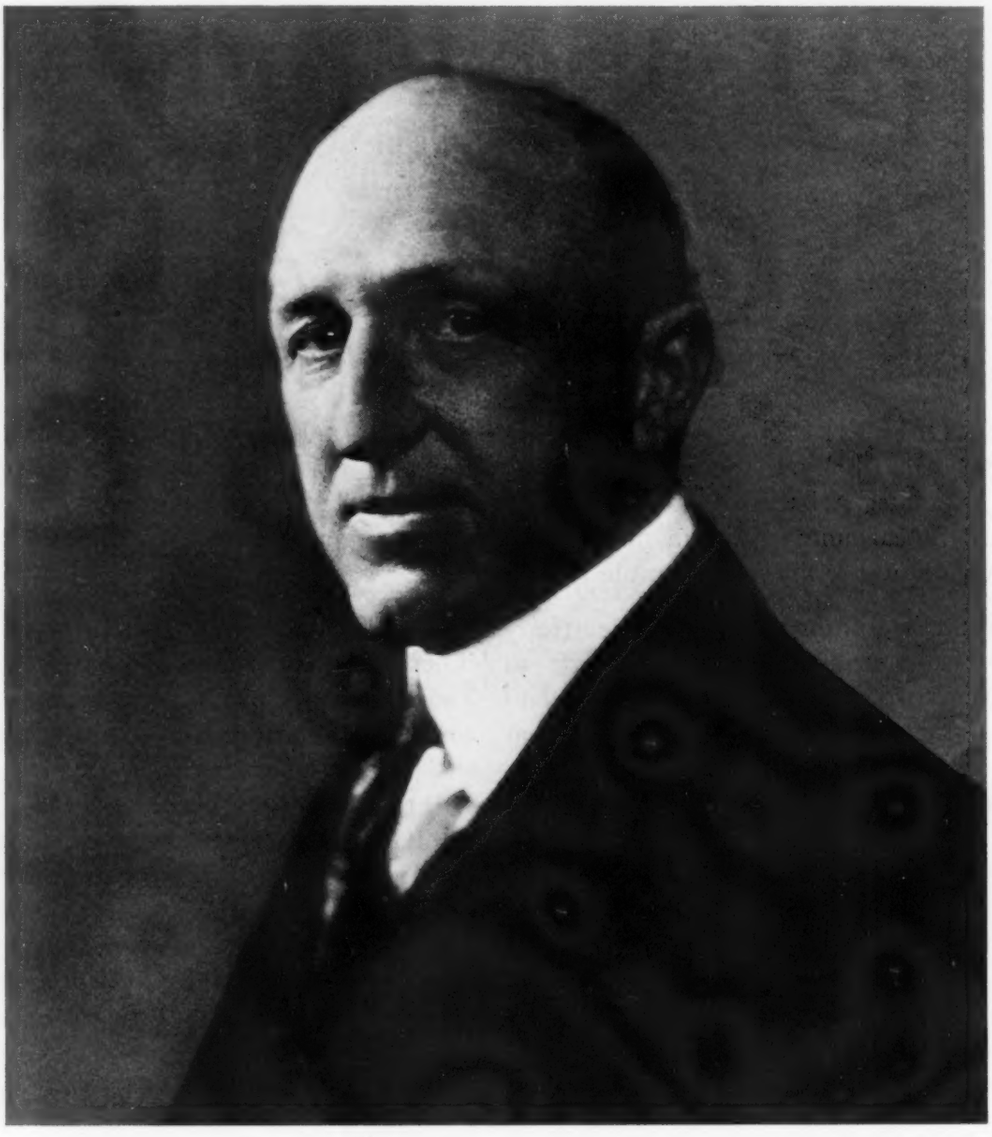
SOMETIMES it is good to think back behind the present scenes and ask what really makes so many wheels go around so fast in this big industry of ours. There is a simple reason.

In the beginning we had but electricity itself, a mystic thing for scientists to putter with. Then a way was found to make this electricity develop light. Then it was turned into a power to drive machinery. Then it was made a source of heat. From that time on to this the industry has grown only as more and more useful things have been devised for electric light and power and heat to do, and more people have been induced to utilize them. And we can only hope for further growth as we increase the number of these applications and their popularity.

It is not the power house or the factory, therefore, that makes this industry what it is, but the lamp, the motor and the heating appliance. It is not the number or the size of generators or transmission systems or the volume of the business done by manufacturers and jobbers. It is the multiplicity of lamps, of motor-driven machines, of industrial ovens and of clothes washers, ranges, grills and cleaners that serve the people of the earth. Here is the measure of our greatness, and no man is thinking straight who does not recognize as vital to us all the problems of increasing the applications of electricity, of making their use more universal, and of maintaining them.

There are many electrical appliances now well standardized and in broad use. There are many others not yet so widely known that will enjoy no less a popularity some day. There are several of these still in the pioneering stage that ere long will rival in their influence and value anything that uses electricity today. In them lie much of the future growth and greatness of the electrical industry. Why is it, then, we ask, that most electrical men remain content to know so little of these appliances and do so little to increase their use?

Surely each one of us should be the leader and the pioneer in things electrical for his own friends and neighborhood. Our homes should be equipped with all the labor-saving and cost-saving devices and as many of the comfort-bringing appliances as we can possibly acquire. We should advocate them. We should personally know how to use them. By our example we should be giving constantly new impulse to the spread of the great idea of "doing it electrically." For after all, it is only for the appliance that the energy is generated.



Charles Otto Lenz

A consulting engineer of wide experience whose work includes the design of some of the best-known plants and systems in the country

IN THE final analysis the backbone of any industry are the men who get things done, for after all it's results that count. In this category belongs C. O. Lenz, consulting engineer, who while specializing in steam power plant construction, hydro-electric development and refrigeration has an experience covering the entire range of a consultant in the generation, transmission and utilization of electrical energy.

Mr. Lenz is a product of New England, having been born at Providence, R. I., in 1868, and graduated at the age of twenty-one from the Massachusetts Institute of Technology. His first three years after graduation were spent in New York in the engineering department of the Edison General Electric Company. In 1892 he went to Chicago, where he became associated with the late Frederick Sargent as assistant engineer for the World's Columbian Exposition, in charge of all power equipment design, construction and installation, except that in Machinery Hall. This association with Mr. Sargent really marked the beginning of Mr. Lenz's consulting work for at the conclusion of the Exposition he joined the Sargent & Lundy engineering organization as first assistant engineer to Mr. Sargent. In this capacity he designed the Harrison Street Station of the then Chicago Edison Company and the first Commonwealth Edison station, besides electric power plants for the Milwaukee Railway Company, Cincinnati Edison Company, United States Electric Company, Washington, D. C.; Union Traction Company of Anderson, Ind., and Toledo Traction Company. In 1900 he resigned to go with J. G. White & Company, in New York, where he was assistant engineer in charge of design and construction of plants for the Toledo-Monroe Railway, Colorado Power Company and Imperial Electric Light & Power Company of St. Louis, besides being chief engineer in the design of power plants in Manila, Porto Rico, Rutland, Vt.; La Fontaine, Ind., and Harrisburg, Pa. From 1905 to 1908 he was associated with Sanderson & Porter, where in addition to designing a number of plants he was engineer in charge of the Brooklyn Edison valuation and the valuation for the city of New York of United Electric Light & Power Company and Katonah water power properties.

In 1908 he established a consulting engineering office and during the thirteen years he has been thus engaged he has had a varied experience. His most important work in that connection was the design and construction of the 96 000-hp. development of Tallulah Falls for the Georgia Railway & Power Company, which was placed in operation in 1913. The main substation for supplying Atlanta with a rating of 30,000 kva. was then said to be the world's largest outdoor substation. He also built the Cabin Creek plant of the Virginia Power Company. Mr. Lenz also is a fellow of the A. I. E. E.

No better tribute could be paid to any engineer than that by the late Frederick Sargent, his early guide and constant friend, who once said: "Give it to Lenz and then forget about it. It will be done, and done right."

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Muscle Shoals Again in the Limelight

ACCORDING to the daily press Henry Ford has made the government an offer for the hydro-electric and nitrate plant at Muscle Shoals, on the Tennessee River in Alabama, when completed. This should give rise to some thought on the part of Southern power companies operating in that district. Last winter when the water power committee of the National Electric Light Association was in session in Washington these companies were anxious to know what the new administration's attitude was toward Muscle Shoals, and the Electrical World secured for them from Secretary Weeks of the War Department the very definite assurance that if any private corporation would agree to take over the plants he would petition Congress for the money with which to complete them. It was the expectation that the price per kilowatt would approximate the pre-war cost of other Southern hydro-electric developments, and that the difference would be accepted by the government as a war loss. It was also thought that a syndicate could be formed to take over the projects and that the energy would be apportioned among the several power companies having need of it. Whether any decision was ever reached we do not know. What we do know is that the Alabama Power Company has started a new hydro-electric development on the Coosa River, so that if the government completes the Muscle Shoals project and sells it to Henry Ford an interesting situation will develop. Either the output will be used to make steel or automobiles or it will be offered for sale in a market already well served. And thereon will hang a tale. The whole history of the Tennessee River and of Muscle Shoals is interwoven with romance and politics, chiefly the latter, and the final chapter, we are sure, will not be one whit less absorbing and exciting in its details than the other chapters have been during the past decade.

Police Value of Public Street Lighting

THE refusal of the City Council finance committee of Chicago to grant pay increases to linemen, repairmen and power house operators employed by the city caused a strike of the employees of the municipal electrical department last week and for a time a section of Chicago's streets remained unlighted. Fortunately the strike was of short duration, but the lesson was none the less effective and ought not to go unheeded, although it undoubtedly will. The late Theodore Roosevelt when he was Police Commissioner in New York City was credited with the statement that one street arc lamp was equivalent to one policeman, and it is generally recognized that light and crime are rarely found together. Hence, any one who willfully darkens the streets endangers public safety and is an enemy to society. We hope that the time will come when strikes on any public utility will be treated as a crime. Nor should there be any occasion for them. All differences should be subject to compulsory arbitration, and within reasonable limits no employee whose presence is absolutely essential to the continuity of the service should be permitted to withdraw until a substitute has been found. This is all in the public interest, and that in the utility business is paramount. It is expedient, moreover, that employees of public utilities be properly looked after and adequately paid. They should be as satisfied in their calling as policemen and firemen; in many respects their work is just as important and just as essential to the public welfare as that of the guardians of the peace and the fire protectors.

The Tariff and the Electrical Industry

WHEN the government of the United States proposes to protect infant industries against foreign competition by means of a tariff we are heart and soul for it; but when it proposes to erect a high wall around full grown and husky industries and sometimes monopolies, we think it is time to protest. We have already protested against a tariff on oil and now we just as emphatically protest against any tariff on copper and aluminum. Producing and exporting more copper than any other country in the world, why should the copper producers need or seek protection? The electrical industry is a large user of copper and also of aluminum, the price of which is fixed by that of copper, and therefore the industry will suffer in a non-competitive copper market. As for aluminum, we have always felt that the price was too high and that there is little or no competition in its manufacture.

The electrical industry also employs large quantities of graphite, carbon and mica, for brushes, electrodes and for insulating purposes. The best grades of mica we must import; but graphite and carbon we produce in abundance. We fancy the difficulty is one of quality rather than quantity, and inasmuch as quality can be secured if sought after, we doubt the wisdom of penalizing our industry, which needs and is willing to purchase the best the market affords. One foreign company already has established an electrode manufacturing plant in this country, and if an oppressive tariff is put on carbon and graphite other foreign companies are sure to establish factories here also. Cheap labor need not be feared. American labor through the wider use of machinery produces far more than European labor and is more enlightened and efficient.

We are the world's greatest user of electricity in industry and yet we do not begin to use half enough. If the country would use more machinery all industry and labor would be better off. We regret to see the proposed tariff on incandescent electric lamps and

bulbs, because, while compared with the ordinary oil lamp chimney the incandescent electric lamp is cheap despite the numerous processes it passes through in manufacture, still a little competition would do no harm, and the lamp industry is no longer an infant in arms needing protection. American incandescent lamps are the finest in the world because American research has made them so, and we feel American skill can outmatch anything that Europe or Asia can produce.

Analysis of Distribution Systems Is Essential

TO SOME engineers who are responsible for the operation of distribution systems they have too often appeared so complicated that any effort to analyze and systematize them has seemed a task of such magnitude that it has never been undertaken. However, the general tendency nowadays is toward acquiring a working knowledge of conditions in all fields. Theodore H. Rice's paper reflects this tendency and indicates means of so arranging the information regarding the distribution system that maps and records can be readily made and kept. Any operator with this equipment can proceed to improve or add to a system along definite lines and with good chance of effecting economies, if proper cost analyses are made to substantiate a general policy.

Perhaps the most striking fact is the demand that exists at present for some convenient means of indicating the load conditions on distribution transformers. A device easy to install and reasonably priced that would give warning when a transformer is in danger of overheating because of overload must undoubtedly be produced in the near future. Some device of this nature that can be read from the ground will be especially desirable on overhead construction. Aside from the evident saving in the amount of testing required to insure transformers against dangerous overloads, it is unquestionable that with a dependable device of this nature it will be possible to carry high average peak load on transformers and thereby considerably reduce transformer investment. It is gratifying to find a general desire for economy on distribution lines in the many efforts that are being made to obtain accurate knowledge of conditions on distribution systems.

Calculation of Power for Industrial Heating Is Simple

INDUSTRIAL operators are beginning to understand that electric heating pays at costs now readily attainable just as central stations are just beginning to realize the importance of industrial heating as a steady and paying load. In the current issue Harold Fulwider considers from an intensely practical standpoint the calculation of power required for the ordinary cases of industrial heating, such as japanning ovens, core-baking ovens, and the like. His working out of practical examples brings out very clearly how computations should be made for similar cases. In the case of ordinary oven work, such as japanning, the material baked, together with the truck on which it is placed, must be brought to the baking temperature, which requires a perfectly definite amount of heat, dependent on the specific heat of the material. Furthermore, the vapors driven off from the solvent must be disposed of so that the volume of air to be heated to the working temperature for each charge is definite. Then there is loss from general radiation, loss through the doors when opened for changing the charge or for inspection, and another loss in raising the oven itself to the working temperature at the start. In instances like core baking, where considerable water has to be evaporated, the latent heat of vaporization is not an unimportant item, in the example cited accounting for a full quarter of the total energy. After the foregoing factors have been taken care of there is a certain amount of unclassified radiation and convection losses which depend largely on the particular way in which the oven is used, but these hardly amount to 15 per cent of the total. Speaking generally, the actual efficient work done in an oven engaged on such tasks as Mr. Fulwider considers appears to run between two-thirds and three-quarters of the entire energy input, which is certainly a figure that does vast credit to the electrical method.

Efficiency Versus First Cost

THE purchaser of large power equipment in considering competitive bids always considers the guaranteed efficiencies as well as the first cost. But how many purchasers of moderate-size machines consider efficiency? This question is raised by Miles Walker in a recent number of the *Electrician* (London), who states that the average purchaser, not being able to test the manufacturer's claim for efficiency, is more influenced by the question of first cost, and that manufacturers recognizing this fact are showing an increasing tendency to cut down the amount of material in industrial equipment, thereby lowering the efficiency. The condition is aggravated in the case of many motors by supplying them with fans, which so improves ventilation that a large loss may be carried on a small frame. The fan itself, however, adds considerably to the windage losses.

The question raised is, in effect, whether Kelvin's Law should not be applied to small machines. In the article referred to figures are given of typical cases in which the weight of field copper would have to be increased from two to four times if the most economical size of wire were to be used. On similar grounds the same author makes a plea for the use of silicon iron in motors and generators, showing that the resulting improvement in the usual values of iron losses would effect a saving which is far greater than the added cost of the somewhat heavier machine occasioned by the use of silicon iron.

Mr. Walker seems to make a very good point in his claim that electrical manufacturers are proceeding upon the wrong lines in cutting down the first cost of electrical machines at the expense of efficiency. However, we have not noticed any great tendency in this direction in this country, at least among reliable electrical manufacturers, and trust that they will not display such shortsightedness. The cost of the materials in the average machine is generally a relatively small part of the total cost. If efficiency can be substantially increased at relatively small increase in the total initial cost of the machine, it would seem to be advisable that some concerted effort should be made to induce manufacturers to work in the other direction. The importance of the matter lies not so much in the saving to be effected in the continuous operation of one machine or plant, but in the aggregate power saved within a large community or in the country as a whole.

No Utility Priority for Coal Probable

THE chairman of the Interstate Commerce Commission, in view of the present rail and coal situation, has suggested that all public utility corporations lay by a plentiful store of coal before winter sets in. Secretary Hoover has also intimated that storage at this time is desirable and that inasmuch as proper warning has been given it is hardly likely that companies which find themselves short of coal will be favored by priority orders next winter. Be that as it may, the warning is worth heeding. Of course there is an injustice done utilities, and through them the general public, because utilities must tie up much needed capital in coal not now needed and suffer the loss of deterioration and the expense of rehandling just to accommodate the coal producers and railroads. That is too great a price ordinarily to pay for insurance, and too much to ask in the way of co-operation. If the coal producers and the railroads really want to move coal during dull months they might offer inducements in the shape of lower prices and preferential freight rates. It is unreasonable to expect outsiders to interest themselves in the business of others. Every merchant knows how to make goods move from his shelf, if they can be made to move at all, and the electric light and power companies of the country learned years ago how to attract off-peak business. If the coal producers and the railroads would use plain business sense and not try to force other industries to play their game just because coal is absolutely necessary to the life of the country both would undoubtedly fare better in public estimation. There are other seasonal businesses besides the coal business, and apparently those in charge of such business manage somehow to see to it that the public demand is adequately supplied. Might we suggest that the coal operators and railroad executives at this season consider the straw "Katy" and all that it means? Be it a "Panama" or just an ordinary straw hat, it holds for them a lesson.

Combining Power and Water Supply

NOT a few novelties in hydro-electric development have originated in southern California. One of the most interesting examples which have yet appeared is described in this issue of the ELECTRICAL WORLD. Two years ago the shortage of power in the territory around Los Angeles became so acute that something had to be done at once to relieve it. One remedial measure adopted by the city of Los Angeles was to utilize as quickly and efficiently as possible an available power site on its water supply system. One plant operated from this supply was already in use, but a further opportunity appeared at a point nearer the city where a drop of 515 feet would make available about 30,000 hp. The striking feature of the new installation from the hydraulic standpoint is the use of vertical-shaft turbines instead of impulse wheels, each with a maximum rating of 20,600 hp., and so planned that they have their maximum efficiency at a point near average load and corresponding to an equal division of the total present flow through the two turbines. Although the water supply is provided with a surge tank at the head of the penstocks, it was found desirable to install a pressure regulator worked by a hydraulic governor to offset the effects of violent variations in load. An arrangement is provided whereby there is no risk of unsealing the draft tubes. The regulators may be adjusted to bypass any quantity of water up to the full discharge of the turbines in case of suddenly losing the load. For this purpose they have proved their usefulness, since in a single day not long ago they were called into activity five times.

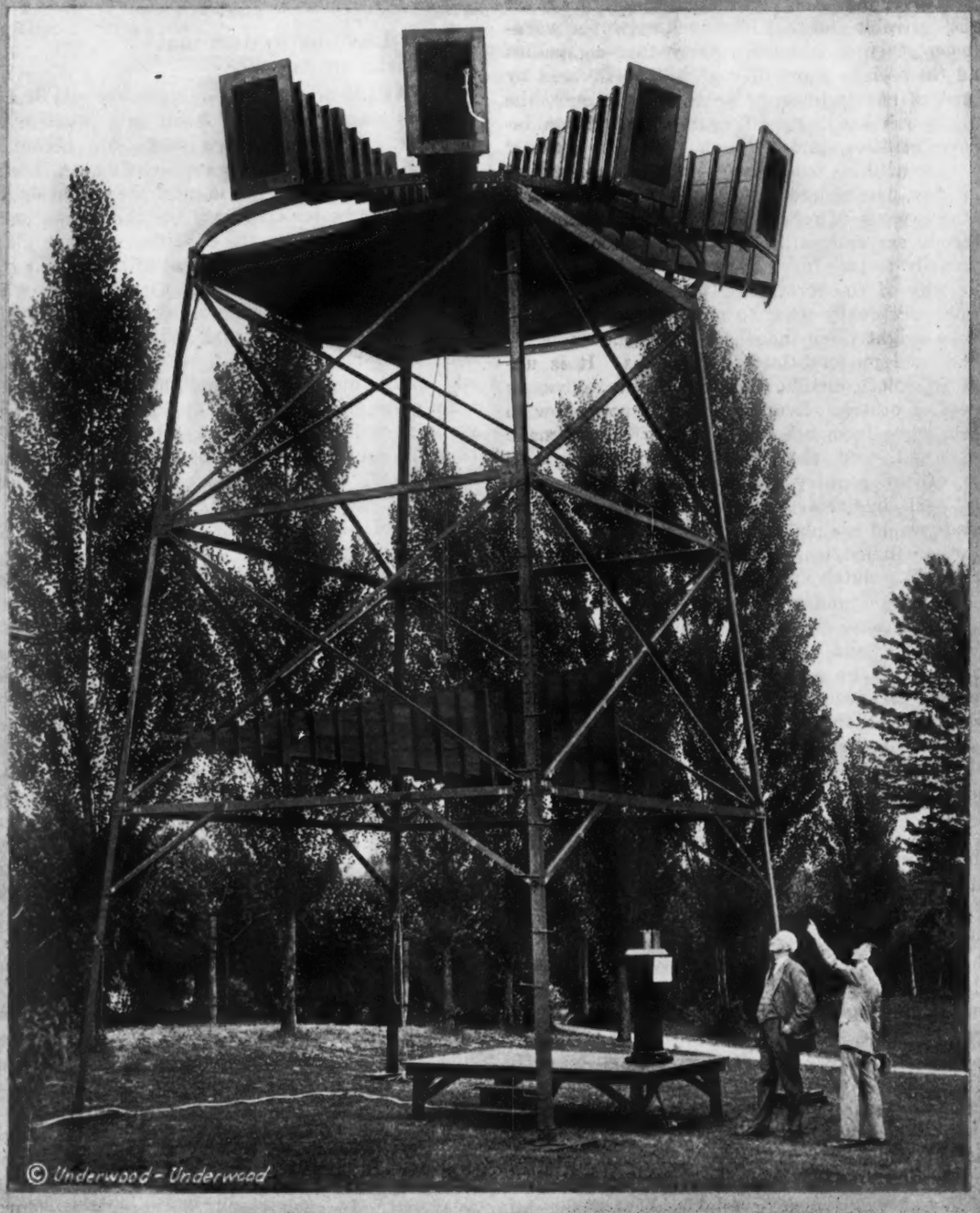
A Park Lighting System that Marks an Advance

SUITABLE ornamental lighting for parks and parkways stands almost by itself as a problem in public lighting. More and more parks are becoming community centers. The ways leading to them carry heavier and heavier traffic, and the situation demands lighting far better than was the case when parks were virtually used only in the daytime. We are glad in our current issue to give an account of the lighting recently installed at Edgewater Park, Cleveland, in which city C. G. Beckwith is the superintendent of lighting. The conditions to be met were in theory simple. It was needful to have fixtures that looked well both by day and night, distributed the light efficiently with minimum glare and gave sufficient illumination on the boulevards as well as in the park proper, while at the same time the equipment had to be simple, reliable and easily maintained. These requirements are not difficult to fulfill today provided that the lighting engineer has the courage of his convictions in breaking away from the bad precedents.

About two years ago the deficiencies of the Cleveland lighting system had become so conspicuous that a change was resolved on, and the present installation, which is an exceptionally good one, was introduced. This latest system consists of 600-cp. gas-filled series lamps carried in lanterns centered 18 feet above the ground and spaced at about 200 feet. The lanterns are of the suspension type, from a bracket arm carried fairly well out and provided with glass panels in bottom and sides. The light is well distributed by the rippled opalescent glass, and the lamp is equipped with a dome refractor and with a curved reflector which keeps the light well down, inasmuch as in parkways no considerable amount of upward light is either necessary or desirable. This well-chosen mounting height gives an admirable distribution of the light, and the lantern equipment has proved singularly easy to clean and keep in order. The lantern itself is suspended by a bayonet joint, and when cleaning is necessary the cleaner need only take the lamp out through the hinged panel at the side, turn the lantern and take it down. The lamps themselves are of the high-amperage type, and there is an individual two-coil transformer in the base of each of the rolled-steel poles. A unique safety device in the form of a lighted bull's-eye is provided on each post to avoid danger to traffic which might arise in case a lamp went out. In each standard there is a colored glass bull's-eye about 6 feet up, behind which is a small lamp in multiple with the main lamp on the transformer circuit. So long as the main lamp is burning the voltage on the signal lamp is so reduced that there is a barely visible glow, but if the main lamp burns out, the signal lamp comes up and makes the presence of the standard particularly prominent.

Altogether it is an installation which marks an advance in the technique of park lighting and furnishes an example which ought to be followed by cities and towns in other parts of the country.

Population of United States Assembled Could Hear One Speaker with This Equipment



A RECORD in projecting speech has been established by the American Telephone & Telegraph Company at an experimental station in the Catskill Mountains where a speaker's voice was made intelligible 3.8 miles away through the medium of a loud-speaking telephone. The equipment is similar in some respects to that used at recent outdoor addresses to large audiences but has considerably greater amplifying power. It consists chiefly of electrostatic transmitters setting on the pedestal on the speaker's platform, vacuum-tube amplifiers in cascade and the loud-speaking projectors shown on the tower. The single lower projector established the record, the energy amplification being 10^{16}. H. B. Thayer, president, and Colonel J. J. Carty, vice-president of the American Telephone & Telegraph Company, are shown discussing the performance of the equipment.

Ornamental Lighting for Cleveland Parks

Modern System with Gas-Filled Lamps Inclosed in Lanterns of Opalescent Rippled Glass Proves Adequate and Readily Maintained—Rolled-Steel Posts Adopted—Installation Costs per Lamp

By C. G. BECKWITH
Superintendent of Light and Heat, City of Cleveland, Ohio

BECAUSE of the more general use of the city parks as community pleasure centers and the ever-increasing motor vehicle traffic, park and boulevard lighting is assuming a new status. The modern system recently installed in Edgewater Park, Cleveland, was, in so far as possible, designed to embody the following boulevard lighting requirements:

1. The standard should be of pleasing appearance both by day and by night.

2. The equipment employed should distribute the light efficiently, and without causing undue brightness in the direction of the eye.

3. The system should be safe, simple, reliable and easily maintained at its original effectiveness.

4. There should be adequate illumination on the boulevards to facilitate the heavy traffic and to reduce the likelihood of traffic accidents and crime.

5. The system should be of such design that it will satisfy and at the same time advance civic pride.

The new installation may be briefly described as being made up of ornamental bracket lantern posts approximately 20½ ft. (6.2 m.) high over all, carrying 600-cp. gas-filled lamps and spaced 200 ft. (60 m.) apart.

During the past ten years three different systems of lighting in Edgewater Park have been discarded as deficient. The original electric lighting system, which employed overhead wiring and 6.6-amp. open carbon arcs mounted on wooden poles and spaced approximately 400 ft. (120 m.) apart, was replaced in 1912, on account of insufficient illumination, by 10-amp. flaming arcs. Owing to the difficulty of insuring proper candlepower maintenance, the flaming arcs were removed at the end of two years' service. It was at this time that the gas-filled tungsten lamp came into prominence, and its easy adaptation to ornamental lighting was at once recognized. An ornamental system consisting of 250-cp. gas-filled lamps spaced about 250 ft. (75 m.) apart was then installed. However, the type of standard used was a converted gas-post only 9 ft. (2.7 m.) in height, and the extremely low mounting of the light source resulted in a poor distribution of light on the drives and undue brightness in the line of vision. Since the lighting effect was not highly satisfactory and since, in addition, some operating difficulties, due chiefly to faults in the underground wiring, had arisen, plans were made about two years ago to replace the old equipment with a complete modern installation. The very satisfactory appearance and illumination effectiveness and the low maintenance cost of the lanterns developed for the Cleveland "white-way"* installation led to the development of a unit adapting the salient features of this lantern for the Edgewater Park system.

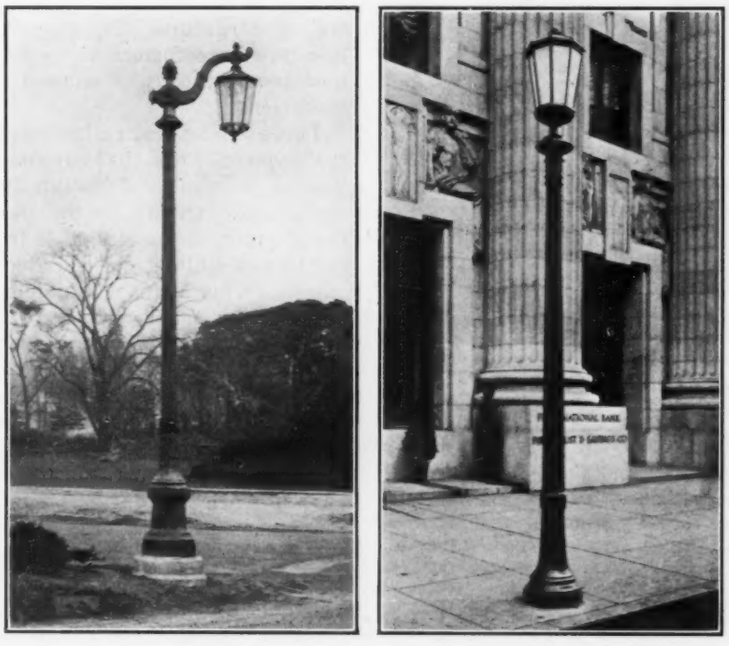


FIG. 1—LANTERN AND POST ADOPTED FOR EDGEWATER PARK, PATTERNED AFTER THE CLEVELAND "WHITE WAY" (RIGHT). MANY PARTS ARE INTERCHANGEABLE

Fig. 1 illustrates the similarity between the two units. The top glass section and center portions of the lanterns as well as the steel column and certain castings of the standards are interchangeable, thus reducing the number of stock parts necessary. Both the park and the "white-way" lanterns are glazed with a slightly opalescent rippled crystal glass. This glass was chosen after experiments with several score of different samples had been conducted with the view of obtaining a glass which, without destroying the very efficient distribution of light from the refractor, would break up the light rays sufficiently to avoid glare and give the impression of a lively sparkle. The glass is placed with the smooth face outward and the lantern is constructed as nearly airtight as is possible without excessive expenditure, in order that dust collection shall be retarded.

Experience has indicated an incidental but practical advantage of the lantern structure in that the replacement cost of broken panels is very low. This results

*See description by Ward Harrison, ELECTRICAL WORLD, Sept. 4, 1915.

not only from the low cost of an individual panel, but also from the circumstance that since the glass is divided into comparatively small sections the chief stresses are carried by the lantern structure, and there is therefore much less tendency for the glass to become broken than in the case of a single globe of comparable size held only by a fitter.

In white-way lighting it is desirable to employ some type of globe or lantern which allows sufficient light upward to illuminate the façades of the buildings and relieve the tunnel-like appearance of the street which would otherwise prevail. This desideratum does not obtain in park or boulevard lighting, and therefore the park lantern was designed to have but a small proportion of upward light. Thus, while the "white-way" lantern is equipped with a band refractor and a flat reflector with a comparatively large opening in the reflector for the upward component of light, the park lantern is equipped with a dome refractor and a curved reflector which allows very little light to be transmitted upward.

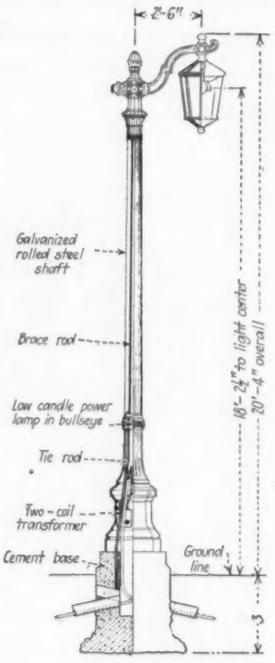


FIG. 2—STEEL SHAFT WILL NOT BREAK READILY AND THE LANTERN GLASS IS READILY REPLACED

Except with levels of illumination corresponding with that provided in the principal business district of Cleveland, where 1,500-cp. lamps are spaced approximately 85 ft. (26 m.) apart and placed opposite each other on both sides of the street, it is necessary to depend for the discernment of objects to a very considerable extent on silhouette and shadow effects. The silhouette may be either against the spot of light beneath a lamp or, particularly in the case of boulevards which have acquired a black polish from heavy continuous traffic, against the mirror-like streaks of light reflected by the gloss of the pavement surface. In order to obtain the maximum benefit from this so-called glint effect and also to obtain a better distribution of light on the street with the minimum of light interference from tree foliage, the park standard was designed to have the lantern suspended from a bracket arm extending over the street. An increased downward candlepower is obtained by placing glass panels in the bottom of the lantern. The candlepower distribution curve is shown in Fig. 3.

The standards employed are of corrugated rolled steel with cast-iron arm, capital, and base, the whole being held together by three tie rods running up through the columns (Fig. 2). This construction of standards was adhered to following the very satisfactory results obtained with the rolled-steel columns in the "white-way" installation. There it was found that damaged standards could be repaired in almost every instance at a comparatively low cost, and that owing to the rigidity of the lantern the glass panels were seldom broken even though the standards were in some accidents bent at right angles.

The park installation to date has about 200 600-cp. gas-filled series lamps which are divided into four circuits. The lantern suspension arms are placed about 20 ft. (6 m.) above the ground, and the standards are spaced approximately 200 ft. (60 m.) apart. In the base of each there is an individual two-coil transformer which eliminates the necessity of film cut-outs and the danger from high-voltage wires and also allows the use of the more efficient high-amperage lamps. The underground cable employed is No. 8 B. & S. two-conductor, with 6/32 in. x 2/32 in. (4.8 x 2.1 mm.) paper insulation, jute filling and $\frac{5}{64}$-in. (2-mm.) lead sheath, and is placed in 3½-in. (8.9-cm.) fiber duct 24 in. (60 cm.) underground. The cascade method of control with pole-type transformer is used. Fig. 4 shows in detail how the method was worked out for this specific installation.

There are several rather novel features introduced in the system with the purpose of insuring safety to vehicle drivers and facilitating maintenance of the equipment. Owing to the physical characteristics of the grounds, it was desirable in several places to change the line of units from one side of the boulevard to the other. Where this arrangement is resorted to the cross-over is made obvious by placing the first unit of one line exactly opposite the last unit of the other line on the other side of the drive.

A difficulty in the case of some underground installations is the inconvenience experienced when repair or replacement of a section becomes necessary. In this installation the fiber duct is curved up through the base of each standard as shown in Fig. 2. This arrangement provides easy access to the cable and an outlet from which sections of cable may be drawn from one standard to another.

From previous experience a cleaning schedule was planned for this system whereby at intervals of a month the accumulation of dust and dirt is removed from the glassware by brushing and washing with hot water. In addition to this monthly cleaning the complete lanterns will be taken to the substation at least once each year for an exceedingly thorough scrubbing with a brush and cleaning compound in boiling water, followed by an inspection and overhaul to renew any cracked glass panels or other defective parts. In order to facilitate the removal of the lantern from the bracket a somewhat novel construction was developed in which the wiring and socket are not connected to the lantern but remain a permanent part of the bracket arm. The lantern itself is carried by a bayonet holder.

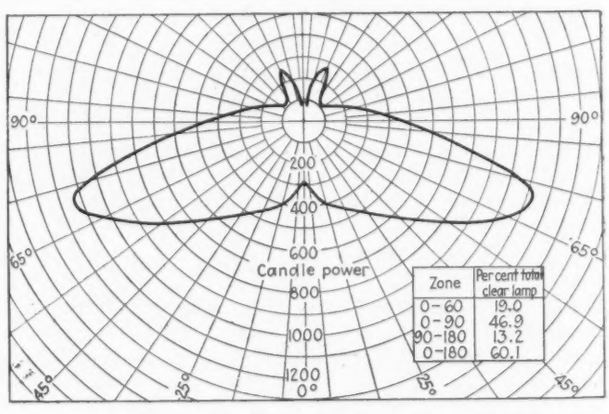


FIG. 3—PARK LANTERN HAS GOOD CANDLEPOWER DISTRIBUTION CURVE

Hence when the lantern is to be removed it is only necessary to take the lamp out through the hinged side-door panel, lift the lantern slightly and turn it, which frees it completely. Even though the lantern can thus be very easily and quickly removed or replaced, the construction of the holder is such that there is no likelihood of a lantern becoming detached by accident or by vibration in the wind.

With a lamp outage there is, of course, an area left in comparative darkness, and in the past it has been

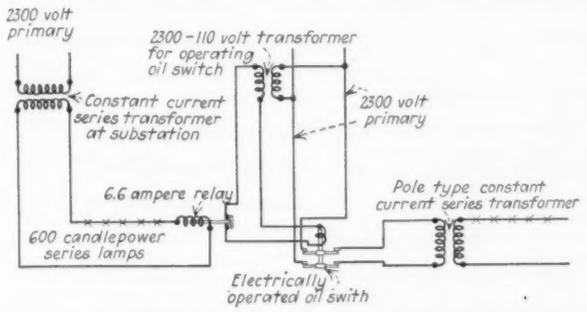

2300 volt primary
2300-110 volt transformer for operating oil switch
Constant current series transformer at substation
2300 volt primary
6.6 ampere relay
Pole type constant current series transformer
600 candlepower series lamps
Electrically operated oil swith

FIG. 4—CASCADE METHOD OF CONTROLLING POLE-TYPE CONSTANT-CURRENT TRANSFORMERS USED AT EDGEWATER PARK

a rather common occurrence for the driver of a fast-moving vehicle to collide with a standard which, installed on a curved drive, could not when in darkness readily be distinguished. In order to eliminate the likelihood of these accidents, there is placed in each standard about 6 ft. (1.8 m.) above the ground a bull's-eye with colored glass in which is installed a low-wattage lamp connected in multiple with the 600-cp. lamp off the individual two-coil transformer (Fig. 2). When the large lamp is in operation the signal lamp behind the bull's-eye burns at such a low voltage as to emit only a very faint glow. However, immediately upon the failure of the main lamp the signal lamp, because of the open-circuit rise in voltage on the secondary of the two-coil transformer, is subjected to its normal voltage and the bull's-eye signal shines out brightly.

The accompanying table, based on fifty lamps per circuit spaced 200 ft. (60 m.) apart, gives installation cost data per lamp on the park installation, excluding

TABLE OF INSTALLATION COSTS PER LAMP

3½-in. fiber duct, at $0.079 per foot	$15.80
Laying duct (trenching, cementing, cable pulling and back-filling), at $0.12½ per foot	25.00
Cable (No. 8 B. & S. two-conductor $\frac{5}{32}$-in. x $\frac{5}{32}$-in. paper with $\frac{1}{64}$-in. lead sheath), at $0.25 per foot	50.00
Cement base in place	22.00
Standard and lantern, glassware and signal lamp	187.23
Erection of standard and lantern	8.58
600-cp. gas-filled 20-amp. lamp (contract $50,000)	3.20
Individual two-coil (6.6 amp. to 20-amp.) transformer	13.54
Pole-type 6.6-amp. constant-current transformer-regulator ($393.75)	7.88
6.6-amp. relay ($40)	0.80
Electrically operated oil switch with inclosed transformer ($110)	2.20
Incidentals	1.79
Total	$338.02

station equipment and high-tension distribution. The material was purchased during the first three months of 1920 and installed during the summer of that year. As there has been a considerable downward trend in prices, it is expected that future additions will be made at a lower cost.

Acknowledgment is made to the engineering department of the National Lamp Works, through whose aid in engineering design and laboratory experiments the conception of the Edgewater Park system was made practical.

Modernizing Distribution

Specific Outline of Method for Making a Survey for the Purpose of Redesigning a System of Haphazard Growth

BY THEODORE H. RICE
Engineer Henry L. Doherty Company, New York City

CONSIDERABLY more attention is being given to the question of electric distribution economies than formerly, owing apparently to a realization that a rapid development of these systems from small beginnings has not generally resulted in an economical lay-out. Excellent possibilities for improvement in operation and economy exist in many communities, and a number of companies have actually started the reconstruction of their systems with the object in view of obtaining the highest efficiency possible and a type of construction that will conform with a definite standard.

So that certain companies might not start such a reconstruction program without first weighing the salient factors that are essential, it has been thought advisable at this time to outline the methods followed in other properties of making a survey of their present distribution systems and planning a future program. From past experience it has been very evident that the cost of making a complete engineering survey of the different distribution systems is negligible compared with the improved efficiency of operation attained.

Although this article is prepared to cover electric distribution systems in cities of 20,000 to 100,000 inhabitants, still the general plan is applicable in larger cities, allowing for slight changes as local conditions may require.

Different methods may be used in gathering the desired information on an existing system, but still the data that are essential for the intelligent planning of a proposed system will be virtually the same regardless of the procedure followed. Therefore an outline of those salient points is given below.

In order to simplify the compilation of the information gathered, it is considered best to cover the survey under four major headings. These divisions with their respective subdivisions follow:

STUDY OF THE PRIMARY LINES

1. Each primary feeder should be traced through its entire length from its source to the point of transformation.
2. A note should be made on the field map wherever the size of conductor changes.
3. Determine whether the feeder is single or polyphase and the class of load connected thereto.
4. Determine whether the circuit feeds to a center of distribution or whether transformers are connected its entire length.
5. Note the location of sectionalizing switches that may be used for interconnecting circuits in case of line trouble or for the isolation of those sections where trouble occurs.
6. Make a load test at each point where the size of conductor changes and from this reading calculate the theoretical voltage drop and power loss for the given distance.
7. At each center of distribution and main branch-off make a voltage test, comparing this with the power plant voltage so as to determine the line drop for a given load.
8. Note class of load connected, whether lighting or power or both.
9. Note whether line is constructed according to standard code.

POINTS TO OBSERVE REGARDING TRANSFORMER LAYOUTS

1. Note exact location of transformer on field map.
2. Check size of transformer with actual load test to determine if it is overrated or underrated.

3. Check voltage rating and ratio of transformer as this is important in giving proper service to the customer.

4. As the core loss and aging of a transformer depend upon the core material, it is quite important to know the serial number of the transformer, from which you can determine the year of manufacture. Almost all transformers manufactured since 1909 are assembled with silicon-steel cores, which are considered non-aging.

5. A load test should be made on every transformer to determine if it is of proper size for the particular load.

6. Where connected three-wire on secondary side, a load test should be made to determine if both coils are balanced.

7. A voltage test should be made at secondary terminals to determine ratio of transformers and also whether customer receives proper voltage.

8. Where voltage conditions are poor, a graphic voltmeter reading should be taken over a period of time.

9. Note the type of primary cut-outs used and whether they are suitable for proper protection.

10. A careful inspection should be made of each transformer to determine the condition and quantity of oil.

11. Note whether transformer is properly installed and the condition of primary taps.

NOTES ON THE SECONDARY LAYOUT

1. Determine whether transformer secondaries are connected two-wire, three-wire or polyphase.

2. Trace the secondaries throughout their entire length and note the size of conductor.

3. Compare ampere load on secondaries with size of conductor.

4. Note the distance from a transformer of the farthest customer served.

5. Determine whether the secondaries of two or more transformers are banked together.

6. If secondaries are banked, are suitable sectionalizing switches used?

7. Note character of load served.

8. Check transformer secondary voltage with the voltage at the customer's lamp socket to determine if voltage drop is excessive between transformer and lamp.

9. Determine whether secondary neutral is properly grounded, and if so, where.

10. Note type of ground connection used and frequency of connection.

GENERAL OBSERVATIONS TO BE MADE

A few points not included above but which are important and should be carefully noted are:

1. Whether primary and secondary wires are carried on the same cross-arm.

2. A test should be made on each ground wire to determine whether the resistance is excessive for satisfactory operation of lightning arresters and secondary neutral.

3. All lightning arresters should have a careful inspection at least once yearly.

4. Where tree foliage interferes with a line the necessary trimming should be done, preferably in the autumn or winter.

5. Where slack wire is excessive immediate attention should be given to the line.

6. A thorough inspection of all poles and cross-arms should be made at least once yearly.

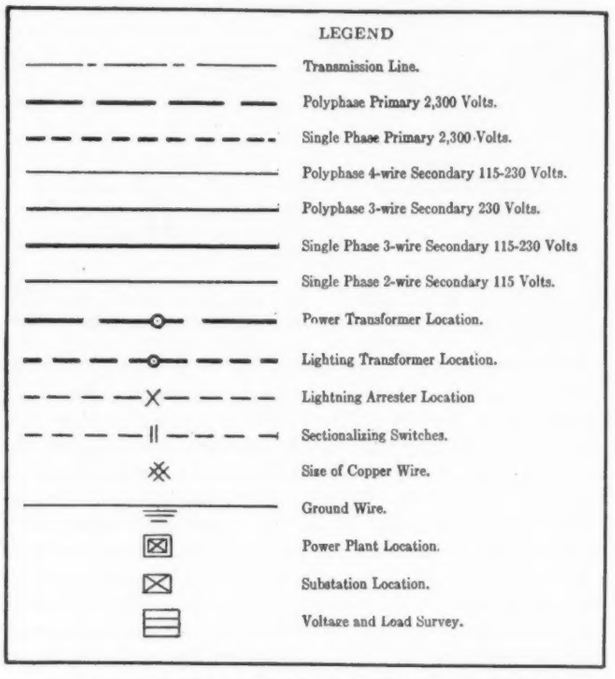
7. An inspection should be made of all service loops.

8. It has been found profitable to maintain a continuous inspection of all meter installations in order to detect possible theft of energy and defective meter and line conditions.

After having made a complete survey of the entire system, it is then advisable to transcribe the field notes as well as to prepare a map to include all the feeders. A good plan in the preparation of this map is to designate the primary and secondary circuits, transformer locations, lightning arresters, primary and secondary sectionalizing switches, ground connection points and the sizes of the several conductors.

To simplify the preparation of this map and still have it legible for the average person, it is suggested that some form of legend be used that will permit future additions or changes to the original tracing without marring its appearance. As it is necessary to change the location of transformers and lightning arresters occasionally, it has been found advantageous to indicate these on the reverse side of the tracing. In this way erasures may be made readily.

After the present distribution system has been reproduced on tracing, then a careful study of the relation between the different feeders should be made to determine whether the circuits are properly laid out to obtain the highest efficiency possible and to serve the community best. In addition to this, a knowledge must be had of the present load conditions, the probable future growth of the town, future power requirements, etc., to plan a reconstruction program intelligently.



SUGGESTED LEGEND FOR DISTRIBUTION SYSTEM DATA

With all this information available, steps then may be taken to lay out a proposed distribution system on tracing cloth in the same manner as the existing circuits. By superimposing one tracing over the other it will be a simple matter to note those sections of line that would need to be newly constructed and those conforming to the proposed plan requiring only regular maintenance to place them in excellent condition.

New construction work should, according to the plan, always conform as closely as possible to the future construction program as formulated. When maintenance work is done consideration should be given to the proposed plan, for in this way it will be only a short time before the entire distribution system will have been rebuilt according to a definite program.

It is important that the service loops and meter installations be in as good condition as the lines; therefore it has been found profitable to make a careful inspection of each service wire direct from the pole to the lamp socket, and then after each day's work is completed the field notes should be checked with the customers' records to determine whether the proper charge is being made the customer. This includes flat-rate customers as well as metered customers.

Electrical Energy from City Water Supply

Station No. 2 on Los Angeles Aqueduct Has Two Vertical Units of 17,500 Kva. Each, Operating Under 515-Ft. Head—Rushed Into Service Three Months After Delivery of Turbines to Help Break Power Shortage

By D. J. McCORMACK
Hydraulic Engineer Wellman-Seaver-Morgan Company

IN THE spring of 1919 the power shortage in southern California became so acute that each of the power companies started construction work on that water-power site which required the shortest time for developing. The city of Los Angeles was fortunate in having a 515-ft. (157-m.) head proposition on the aqueduct with possibilities of early completion. There was no need of constructing any dam or long tunnel for diverting the water to the power house. The power could be turned into the transmission lines from the No. 1 plant to Los Angeles, which pass this site. It is in San Francisquito Canyon, about 40 miles (64 km.) from the city, and is called No. 2 plant. The rapid execution of the project with no attendant difficulty in starting up the plant, the unique hydraulic regulation for variable load on the electrical system to prevent interference with the city water supply, and the various provisions for safe operation of the turbines at the high head utilized are noteworthy features.

Water is carried from No. 1 plant by a 6-mile (9.6-km.) tunnel forming part of the aqueduct. A short distance from the end of the tunnel above the power house is the 35-ft. (10.7-m.) diameter surge tank. From this surge tank the water is led through two riveted steel penstocks, 7 ft. (2.1 m.) in diameter and 1,430 ft. (435 m.) long, to the power house at the bottom of the canyon. The water discharges from the turbines into a tunnel 400 ft. (122 m.) long, again entering the aqueduct at the foot of the former cascade.

The power house is built of reinforced concrete of modern architecture, affording ample space for all the hydraulic and electrical equipment. Except for the penstocks and transmission lines, it would not be recognized as a hydro-electric plant, since there is no tailrace or water in sight.

Rapid Execution of Plans

At present consumption there is about 600 cu.ft. (16.8 cu.m.) per second of water flowing in the aqueduct, which is capable of developing 30,000 hp. under the head of 515 ft. (157 m.). It was decided to use two vertical units with the maximum efficiency of each turbine occurring at a discharge of 300 sec.-ft. (8.4 cu.m. per second), and an efficiency of at least 80 per cent was required at 440 sec.-ft. (12.3 cu.m. per second). This corresponds to a maximum capacity of 20,600 hp. under 515 ft. head. The generators are rated 17,500 kva. at 0.8 power factor and are of the umbrella type with directly connected exciter and spring-type thrust bearing on top. Later on, when a greater demand for aqueduct water is required by the city, a third unit will be installed, and provision was made in the power house for this.

Contracts were let early in the spring of 1919 for the two penstocks, and in July awards were made to the Wellman-Seaver-Morgan Company for all of the hydraulic equipment and to the General Electric Company for all of the electrical equipment. The turbines were delivered in March and April, 1920. The first unit was put in operation June 30 and the second Aug. 7. Seven hours after water was admitted to the second unit it was carrying full load, so great was the shortage of power which had been accentuated by an extremely dry winter.

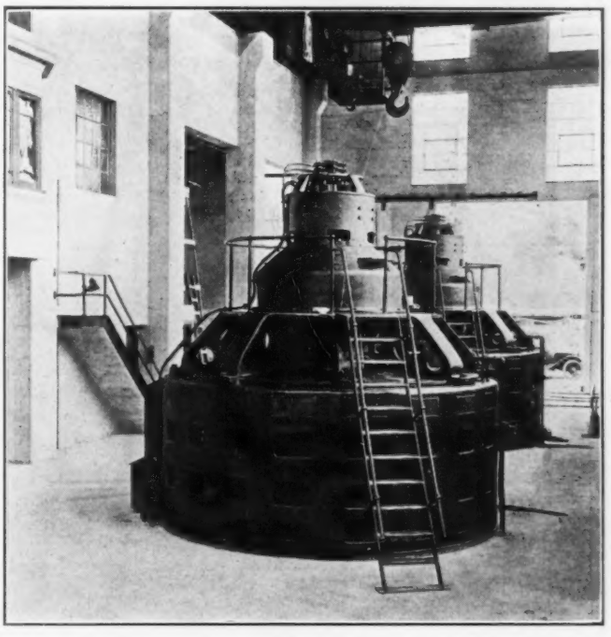
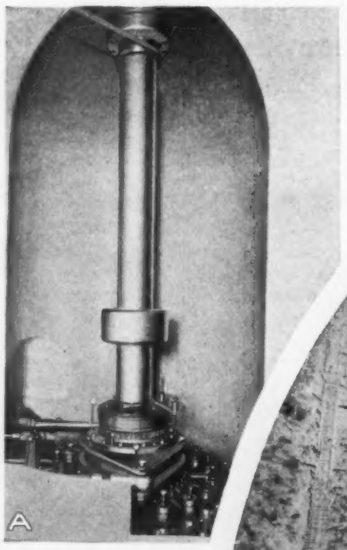


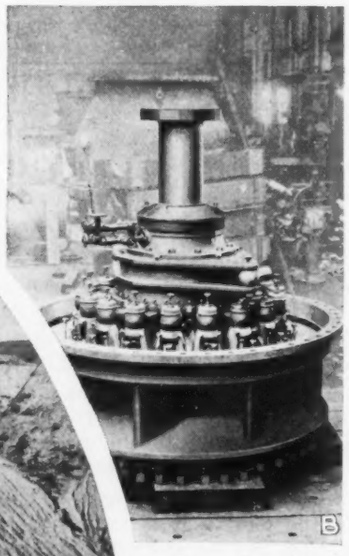
FIG. 1—GENERATORS DEVELOPING POWER FROM AQUEDUCT

Owing to the high head and large capacity, most of the castings for the turbines, needle valves and pressure regulators were made of steel and subjected to a shop-test pressure of 350 lb. per sq.in. (24.5 kg. per sq.cm.). The hydraulically operated needle valves are 7 ft. (2.1 m.) in entrance diameter and 4 ft. 6 in. (1.37 m.) in discharge diameter. A cast-steel feeder pipe with manhole and separate flange, so that the valve may easily be removed for repairs, connects the needle valve to the cast-steel spiral casing of turbine. The casing is 2 in. (5 cm.) thick, has an entrance diameter of 4 ft. 6 in. (1.37 m.) and is made in four sections. At the down-stream end of casing connections are taken off for the 30-in. (76-cm.) governor-operated pressure regulator, 16-in. (41-cm.) bursting plate and drain valve. The pressure regulator discharges through a cast-steel nozzle into a cast-steel conical-shaped velocity killer which is set in the concrete of the floor below. The discharge then passes out into a separate tunnel built above the tailrace tunnel and joining it further down. This arrangement precludes unsealing the draft tubes when the pressure regulators are called into

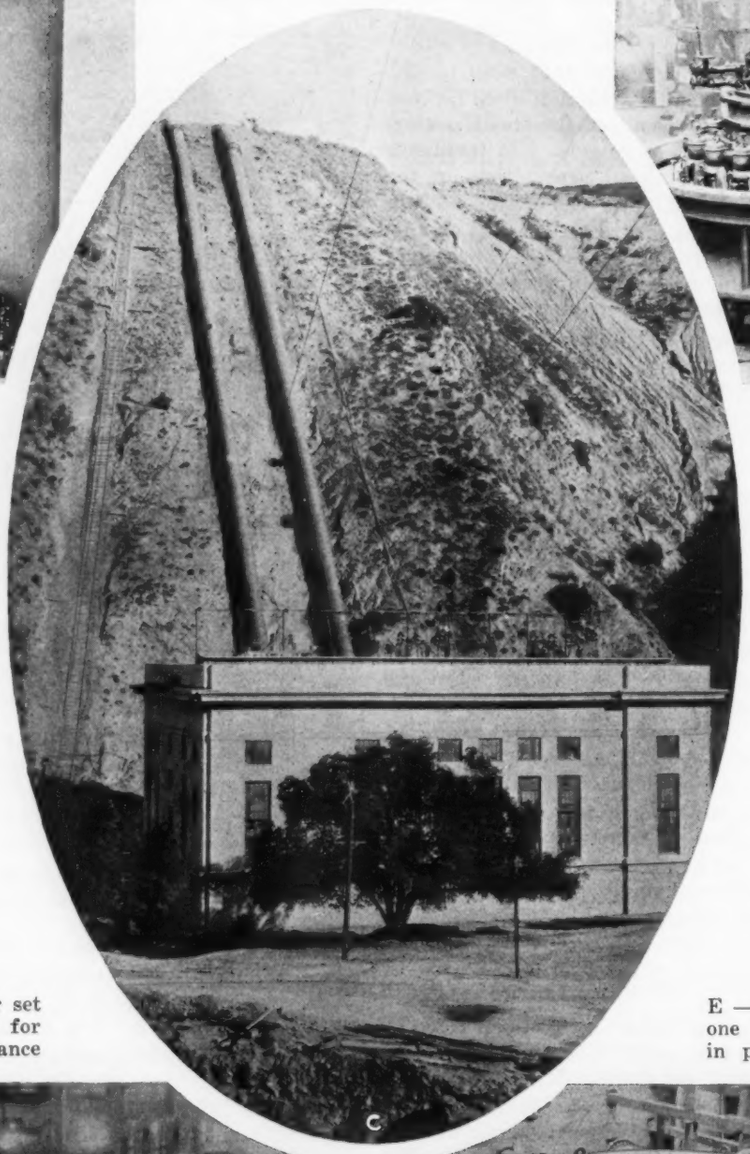
Los Angeles City Water Supply Is Utilized to Produce Electrical Energy



A—Top view of turbine in place in the pit and coupling for generator shaft above

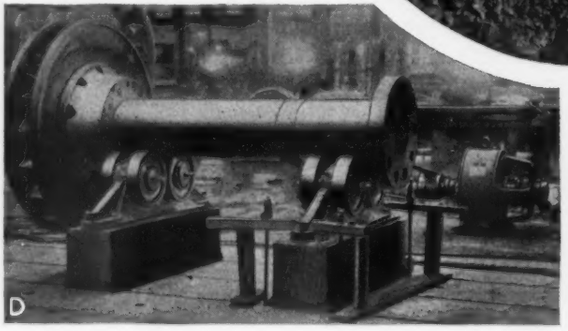


B — Completed turbine erected in the shop before shipment to the station site

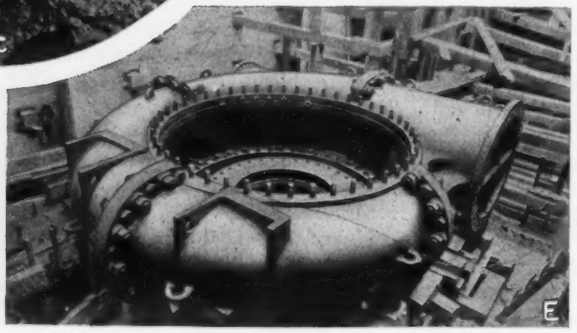


C—Concrete structure housing two 20,500-hp. units with room for the addition of another when the water requirements of the city have increased sufficiently. The turbines operate under a head of 515 feet

D—Turbine runner set up in the shop for test of dynamic balance



E — Spiral casing of one of the turbines in process of erection



operation. This separate tunnel at its upstream end joins the bypass around the power house, this bypass being necessary to maintain a constant flow of water down the aqueduct in case both units should be shut down. In this emergency the water from No. 1 plant above is turned into the bed of the creek, which runs down the canyon to No. 2 plant.

PRESSURE REGULATOR BYPASSES WATER

Each pressure regulator may be adjusted to pass any quantity up to the full discharge of turbine when the turbine gates are suddenly closed and may be set for

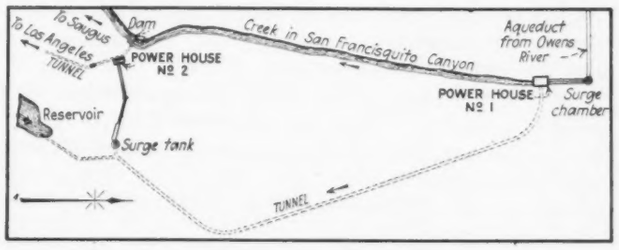


FIG. 2—HOW AQUEDUCT WATER IS PASSED THROUGH THE HYDRO-ELECTRIC STATION

governor operation as a water-saving device, closing slowly enough after each sudden rejection of load to prevent setting up another rise in pressure. If desired, it can be set to bypass any quantity of water when the unit is running. It may also be set as a synchronous bypass or water-wasting device, opening to discharge as much water as is rejected through the turbine gates closing, or vice versa, thus maintaining a constant velocity in the penstock. These pressure regulators are operated most of the time with the water-saving feature. They were called into operation five times in one day owing to lightning trouble and short circuits on the line, nearly full load being lost on the unit each time. One short circuit occurred when one of the units was carrying 20,000 hp. Upon dropping this load suddenly the pressure rise was only 6½ lb. (0.45 kg. per sq.cm.).

The draft tubes are of the straight conical type lined with steel plate at their upper ends with manholes for inspection of runner. The lower ends of the draft tubes are molded out of concrete. Directly below the downstream wall of the power house a low weir was put in to keep the draft tubes sealed.

The turbine speed ring is made of steel cast in one piece with stationary vanes guiding the water to the gates and acting as a tie across the throat opening of the casing. Both the speed ring and the casing are imbedded in concrete at the bottom of the concrete pedestal which supports the generator.

Forged-steel gates machined all over with integral stems, each having three separately lubricated bearings, are connected at their upper ends by cast-steel levers through cast-iron links to the cast-steel operating rings. The links are the weakest element in the gate mechanism and are designed to break before the elastic limit of any of the other parts is exceeded. Special thrust collars are provided to take up the unbalanced thrust on the ends of the gate stems and to carry the weight of the gates. Two servo-motors bolted to the top of the casing and having a total capacity of 45,000 ft.-lb. (6,210 kg-m.) are connected by forged steel rods to the operating ring. On account of the gates being balanced at about three-eighths gate opening and having a maximum tendency to open when in the closed position, and on account further of the high head, a special device was designed to hold the gates closed in case the governor pressure should be released. This is particularly desirable when the unit is shut down but still has water in the casing for the purpose of bypassing it through the pressure regulator.

The runners are of special manganese bronze having an exceptionally hard wearing surface and high elastic limit. Forged-steel bands shrunk on the hub and band of the runner form a special seal with the wearing plate on crown plate. A straight running fit at the curb plate and an effective seal at the bottom of the runner band allows a greater pressure to be built up under the band of the runner in order to reduce the load on the generator thrust bearing. Measurements taken during different periods of operation showed only 15 lb. to 23 lb. per square inch (1 kg. to 1.6 kg. per sq.cm.) pressure on the top of the runner. This was counterbalanced by the greater pressure below the band, which varied from 30 lb. to 40 lb. per square inch (2.1 kg. to 2.8 kg. per sq.cm.). A renewable cast-steel liner was also provided at top of draft tube near discharge of runner.

DYNAMIC BALANCING OF RUNNERS

Great care was taken in the shop to balance the runners for dynamic balance on account of the high speed of 428 r.p.m. and the relatively large diameter of the runner, 63½ in. (1.61 m.), for this speed. After truing up the runner together with the shaft in a large lathe and accurately obtaining a static balance, the runner and shaft together were run up to speed on four large rollers having ball bearings. The runner and shaft were belted to a motor. The two rollers next to the runner were free to move in any direction in order not to dampen any tendency to vibrate. By adding or subtracting weight in the proper plane the runner balance was corrected until the instrument which magnified

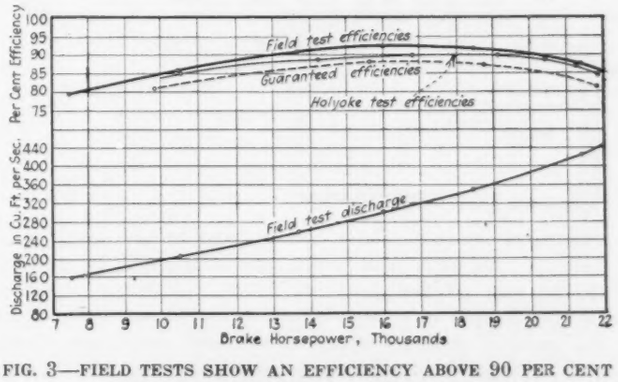


FIG. 3—FIELD TESTS SHOW AN EFFICIENCY ABOVE 90 PER CENT OVER A CONSIDERABLE RANGE OF LOAD

the vibrations ten times showed no movement. The shafts and runners ran perfectly true in the field.

The crown plate is made of cast iron in one piece and supports the operating ring and main shaft bearing. The fact that the water which passes through this plant is used for drinking purposes in Los Angeles precluded the use of an oil bearing, and a lignum-vitæ bearing was decided upon, the water supply to this bearing being taken from the casing. In this supply line are a duplex strainer and a Vaughan current meter with alarm attachment to notify the operator in case the flow is cut off for any reason.

The shaft is 17 in. (43 cm.) in diameter at the bearing and 16½ in. (42 cm.) in diameter for the remainder of its length. It is made in two sections so that the turbine may be dismantled from above and the runner removed without disturbing the generator. A 2-in. (5-cm.) hole is bored through the length of the shaft and flanges forged on the shaft form the couplings. The runner is bolted to one of these flanged couplings.

It was considered better practice not to use any split bronze sleeve on the shaft at the lignum-vitæ bearing. Inspection after eight months' operation showed the bearing surfaces on the shafts to be perfectly polished without a sign of rust. In case the unit is shut down for an extended period, large oil cups on the bearing cover allow oil to be slushed along the shaft.

Four air brakes supported on the arms of the lower generator bearing spider and bearing on the lower surface of the generator rotor are connected by piping to the tops of the governor tanks. The air supplied to the brakes is controlled by an engineer's valve in the control column, which also forms the gage stand and contains the vacuum breaker for the draft tube. To insure accessibility the control column is placed next to the governor on the generator floor. These units are brought from normal speed to rest in five minutes.

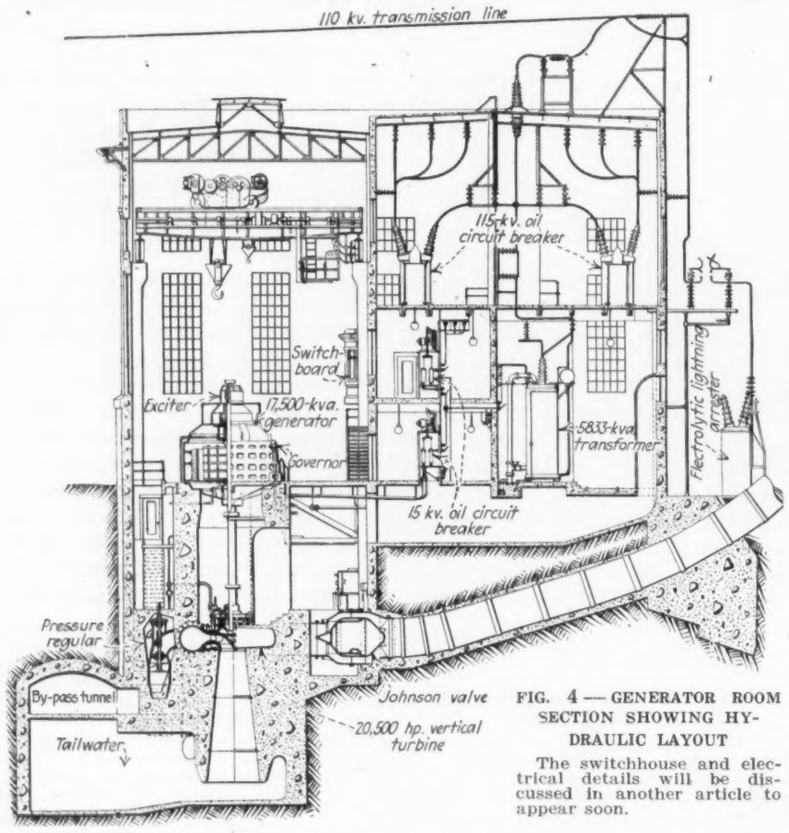


FIG. 4 — GENERATOR ROOM SECTION SHOWING HYDRAULIC LAYOUT

The switchhouse and electrical details will be discussed in another article to appear soon.

The 45,000-ft.-lb. (6,210-kg.-m.) Woodward actuator-type governors are driven by a belt with automatic tightener from the main shaft. An independent hand control consisting of a four-way valve and bypass around the relay valve permits emergency operation of the unit by hand. Under ordinary operation the governors are controlled entirely from the switchboard.

The central pumping system for governors is on the deck beneath the generator floor. Two motor-driven rotary pumps take the oil from a large open-sump tank and discharge into two pressure tanks. Each pump and pressure tank is of sufficient capacity for three units, and they are interconnected to form a duplicate system. It was found that only 145 lb. per square inch (10 kg. per sq.cm.) oil pressure in the governor system was required to operate the gates. The system was designed for 200 lb. (14 kg. per sq.cm.) working pressure. An air compressor replenishes the supply of air in the top of each pressure tank and also serves the brakes.

Plant Takes Load Fluctuations

This plant is very near the center of distribution of the system and therefore serves as the regulating station in the absence of a steam plant. With this purpose in view, a large flywheel effect of 2,000,000 ft. squared-lb. (84,800 m. squared-kg.) was built into each generator rotor. Furthermore, great care was exercised in proportioning the size of the surge tank, penstocks and pressure regulators to allow a minimum time of governor operation. Extremely close regulation is shown by the governors, which have proved very sensitive and dependable.

The sizes and weights of all large sections of equipment were limited on account of the haul of 10 miles (16 km.) from the railroad. An interesting and novel feature of transportation was performed in rolling the second generator rotor and shaft, weighing 100 tons, over the road instead of hauling on a truck. This effected a considerable saving in cost and required less than half the time. Two tractors ahead controlled the direction of rolling and a drag behind aided in rewinding one cable while the other was being unwound.

Conduct of Efficiency Tests

Four months after the turbines had been put into operation, the Bureau of Power and Light of the city of Los Angeles conducted the official tests to determine the efficiency and capacity of the turbines, as well as tests of the pressure regulators and governors. The frictional losses in the penstocks for varying loads were also measured.

A point in the discharge tunnel about 300 ft. (90 m.) from the power house was selected for taking the water measurements. For this purpose the tunnel was calibrated by the engineers of the city water department. A Price current meter was used to calibrate the tunnel. Five separate sets of readings were made to recheck and obtain a very accurate discharge curve of the tunnel. Before and after the readings were taken the Price current meter was calibrated to check its accuracy. The discharge tunnel at this point is 10.2 ft. (3.1 m.) wide. A gage board was placed alongside the tunnel wall at the point where current-meter measurements were taken.

The pressure head was determined by a gage placed on the inlet section of the turbine, and allowance was made for velocity head at this point. The pressure gage was calibrated before and after each test. Measurements of tailwater elevation were taken by a gage

board at the side of the tailrace wall near the draft-tube mouth. In the same manner the water level in the surge chamber was read, in order to determine the pipe-line losses. Electrical readings to determine the output were taken by city test meters and checked and rechecked in the testing laboratory.

The unit under test carried a commercial load, and the gates were blocked for each gate opening. The other turbine was shut down and the needle valve closed to prevent any leakage into the tailrace. For this reason the tests could only be run at night. Five readings at three-minute intervals were taken for each gate opening. Ten minutes was allowed between each gate to obtain steady conditions in tailrace tunnel and surge tank.

PART-GATE AND FULL-LOAD EFFICIENCIES ARE HIGH

The accompanying curves show the results of test on unit No. 1 as compared with the guarantees and the results as based on Holyoke test of a 55¼-in. (154-cm.) diameter runner of same design. On account of the head at Holyoke being only 17 ft. (5.2 m.) and the ratio of mechanical losses to hydraulic losses being greater because of the smaller output it is very hard

FIG. 5—UNIQUE METHOD OF TRANSPORTATING GENERATOR ROTOR, WEIGHING 100 TONS, OVER 10-MILE ROAD

to obtain a representative test there of an extremely high-head low-speed runner. It was expected that the runner would show up much better under a higher head.

A more efficient draft tube accounts for part of the increased efficiency. The remainder is attributed to the vertical arrangement, the careful design of all water passages, the conformance to the design and the high class of workmanship. As a remarkable check the tests of both machines showed identically the same results.

Of particular interest is the point of maximum efficiency occurring at the required discharge of 300 sec.-ft. (8.4 cu.m. per second)—73 per cent of full load—and the high part-gate and full-load efficiencies (440 sec.-ft., or 12.3 cu.m. per second).

The complete freedom from trouble in starting up this plant, its continuous and dependable operation under a high load factor, the absence of pitting and wear in the runner or other water passageways and the good all-around results obtained should greatly reassure hydro-electric engineers in the selection of large-capacity vertical units under very high heads.

The success of this undertaking is an indication of what may be done in other localities where water for domestic purposes may be made to perform useful work on its way from mountainous or elevated sources to the consumers.

Watching Transformer Service

Financial Losses Entailed by Excessive Transformer Capacity, Underloading and Overloading—Simple Card-Record System for Small Utility

BY F. W. RANDALL

Assistant to Vice-President and General Manager Rockingham County Light & Power Company, Portsmouth, N. H.

THE central-station manager striving for economy in the operation of his property might well devote more attention to the design of his distribution system. Particularly in the matter of transformer loading and location, there will be serious losses over twenty-four hours of each day arising from excessive investment in transformers, serious energy losses from incorrect loading or rapid deterioration of the transformers due to heat from excessive loading.

It is generally recognized that the majority of distribution systems are not economically laid out. This is not always the fault of original design, but usually is the result of the growth of the system. Extensions are continually being made to serve new groups of consumers, and it is often the case that these extensions are made without giving consideration to the system results as a whole.

UNECONOMICAL CONDITIONS COMMONLY OCCURRING

Considering the transformer system alone in connection with such developments, any or all of the following conditions may exist:

1. Transformers serving single customers. This was the custom when transformers were first used and many of these installations have not been corrected. Experience and tests have proved that one large transformer feeding secondary mains is more economical both in first cost and operating expense.

2. Transformers too large for connected load. This condition may be due to lack of proper consideration of the connected load or to failure to consider the diversity factor of the load. Sometimes the proper size of transformer is not available and the larger size, installed temporarily, remains the permanent installation.

3. Transformers overloaded. Result of connecting new customers to the nearest secondary without any check on existing connected load.

These conditions represent dollars and cents to the smaller as well as to the larger central station, for they involve not alone a question of original investment but a continual core loss, low power factor, poor regulation and in certain cases overheating and short life.

The larger companies, with their great organizations, give more attention to these problems. Engineering and statistical departments are maintained and records of transformer loadings and similar data are kept and followed up. The smaller companies have frequently considered such records of no value and simply as red tape. While the same departments cannot be maintained, it will be a profitable investment, regardless of the size of the company, to have a simple system of transformer records.

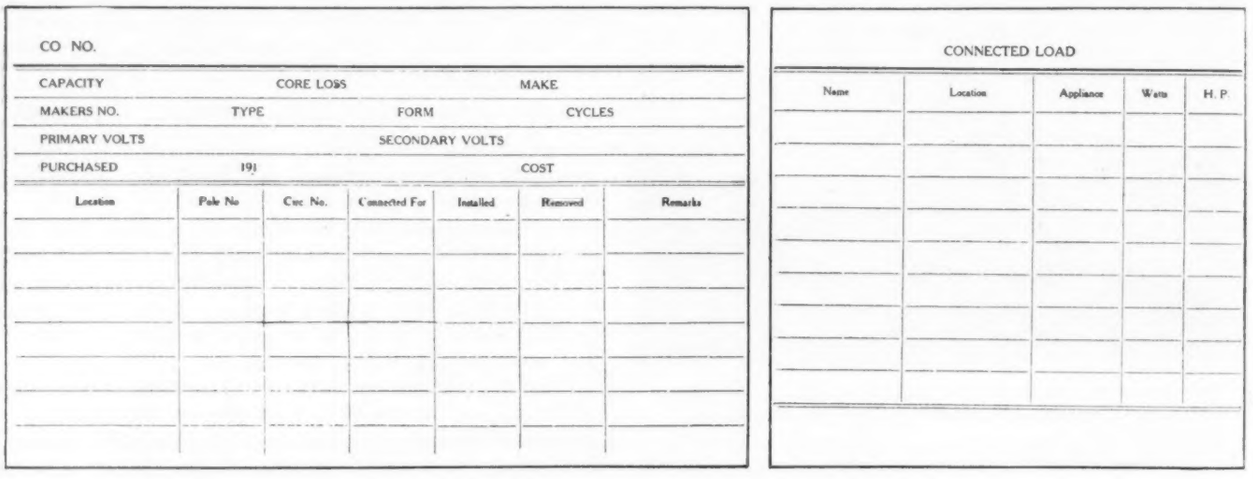
A record on 4-in. x 6-in. cards can be used to give all the necessary information. The front of the card gives transformer data as follows: Company number, capacity, make, core loss, makers' number, type, form, cycles, primary and secondary volts, date purchased and price. It also contains a record of the installation, giving location, pole number, circuit number and date

installed. The back of the card may be used for listing the customers connected to the transformer, with their approximate loads. These cards may be filed by sizes and by towns, map sections or circuits, according to local conditions. Tabs may be attached to the cards to designate whether the transformer is installed for light, heat or power.

Transformers received from the factory should receive a company number and cards should be made for each. These cards should be filed as stock. When the transformer is drawn from stock and placed in service the record of the installation should be made on the card and the card filed in its proper place. This card record alone will prove very satisfactory. If used in connection with maps of the primary and secondary distribution systems, it will be even more valuable.

Periodic inspection of transformers is advisable to determine quantity and condition of the oil. The record of these tests may be noted on the cards.

The central-station official may ask concerning some of the specific ways that this record and this attention to the transformer system will pay him dividends.



CO NO.

CAPACITY		CORE LOSS			MAKE	
MAKERS NO.	TYPE		FORM		CYCLES	
PRIMARY VOLTS			SECONDARY VOLTS			
PURCHASED	191				COST	
Location	Pole No	Circ No.	Connected For	Installed	Removed	Remarks

CONNECTED LOAD

Name	Location	Appliance	Watts	H.P.

A SIMPLE CARD SYSTEM SAVES TRANSFORMER INVESTMENT AND LOSSES

Consider the question of initial investment. Study of the card record will determine whether transformers are larger than necessary and whether some transformers might be eliminated. If the system is equipped with excessive transformer capacity, the correction of this condition will, of course, effect a direct reduction of plant investment.

The question of core loss is of greatest importance, for this is a twenty-four-hour expense and reaches back directly to the coal pile. It is therefore essential to eliminate all unnecessary core loss, and considerable study can be devoted to this subject.

The power factor of most commercial transformers is low at no load, while at normal load the power factor is very good. For this reason it is important to distribute the transformers on the line so that they will carry load enough to keep the power factor high.

Excessive overloading causes increased temperatures, with resulting deterioration and probable shortening of the life of the transformer. Checking of connected loads on transformers will disclose cases of overloading.

In addition to these suggestions of possible economy the card record can be of great service to the line superintendent in giving instructions regarding new services. The record will show whether the new service can be connected to the existing transformer installation or whether new transformers must be installed. In this way the transformer system can be maintained and extended economically.

In case of trouble reported by a customer it is often of advantage to know the names of other customers on the same transformer. A telephone call to one of the other customers will determine whether the trouble is at the transformer or is confined to the complaining customer's premises.

The card record also justifies its existence for report purposes. In these days of questionnaires, plant inventories and public service commission reports a record of the various sizes of transformers in service, under the various classifications already available, means much even to the smaller companies.

The transformer card record will serve still another purpose for companies having a considerable amount of seasonal business. At beach resorts the energy consumption is confined to three or four months a year. It may not be advisable to remove the entire equipment for the rest of the year, but it will prove profitable to remove the primary plugs, thus cutting the transformer from the line and avoiding the core loss. Reference to the list of customers on transformer cards will indicate which transformers may be cut out, and a notation on the card will serve as a record of the cut-out.

Seven New England Companies' Output Over 100,000,000 Kw.-Hr.

THERE are seven central generating and distributing companies in New England with an annual output of more than 100,000,000 kw.-hr. These are, in order of output, the New England Power Company, Edison Electric Illuminating Company of Boston, Narragansett Electric Light Company, Turners Falls Power & Electric Company, Connecticut Light & Power Company, New Bedford Gas & Edison Light Company and Hartford Electric Light Company. The output of Connecticut Light & Power Company in 1920 was 145,111,822 kw.-hr., of which 124,454,140 kw.-hr. was generated and 20,657,682 kw.-hr. was purchased. Of the total output, 121,285,281 kw.-hr. was distributed to light and power customers and 23,826,541 was sold to electric railways. The peak load for 1920 was 33,392 kw.-hr., occurring on Oct. 12.

Requirements for Industrial Heating

How to Determine Power Required for Ovens and Energy Consumption per Unit of Product—Typical Calculations for Japanning and Core-Baking Ovens—Selection of Ventilating Equipment

By HAROLD FULWIDER*
Industrial Heating Engineer General Electric Company

WITH the rapidly increasing use of electric ovens for industrial heating purposes the need frequently arises for calculating the probable connected load and energy consumption to handle a process by the electric method. The heat required may be considered in parts as follows: (1) The heat of absorption necessary to raise the temperature of the trucks, conveyors, carriers, oven walls, etc., from room temperature to oven temperature; (2) the heat required to raise the temperature of the fresh air necessary for ventilation, and (3) the radiation loss.

In order to show how the heating requirements may be translated in electrical units a typical problem may be considered.

Problem.—Required to find the energy consumption and connected load for a japanning oven baking at 450 deg. Fahr. for forty-five minutes. Weight of charge, 1,000 lb.; weight of truck, 300 lb.; room temperature, 50 deg. Fahr.; walls of 4-in. Nonpareil pressure block; outside surface of oven in square feet, 232.

CALCULATION OF HEAT FOR ABSORPTION

The following is a simple formula which may be used for the calculation of absorption by the oven load:

Heat of absorption (kw.-hr.) $= (W \times S \times T) \div 3{,}412$, where

W = weight of charge and truck in pounds,
S = specific heat of material baked (average specific heat of iron from 0 deg. to 500 deg. Fahr. = 0.12),
T = temperature rise, deg. Fahr. 3,412 = B.t.u. in kw.-hr.

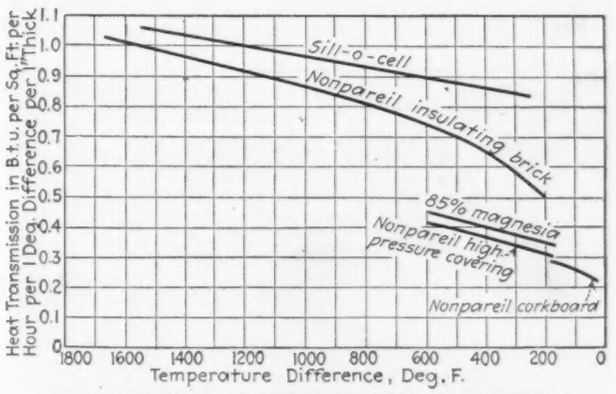
From the information on the oven under consideration, it may be seen that the weight of the material, including charge and truck, is 1,000 plus 300, or 1,300 lb. iron. The temperature rise equals 450 deg. Fahr. — 50 deg. Fahr. (room temperature) = 400 deg. Fahr. Therefore:

$$\text{Absorption} = (1{,}300 \times 0.12 \times 400) \div 3{,}412 = 18.3 \text{ kw.-hr.}$$

One of the most important points about the correct operation of a japanning oven is its ventilation. This is so because proper ventilation renders an oven immune from fire or explosions and insures safe operation. By proper ventilation is meant that amount of air which passing through an oven insures safe operation and at the same time gives sufficient drying and oxidizing atmosphere for the japan being baked.

It must be borne in mind that explosive vapors are driven off in the japanning process and also that the fire and explosive hazard can be eliminated by baking in a neutral oven atmosphere. Since thinners used in japan volatilize readily in air at room temperature, safety and best baking conditions demand that the work be allowed to hang after coating with japan at least twenty minutes before it is subject to baking heat. A good way to allow for a twenty-minute drip is to provide an intermediate loaded truck between the material being dipped and the one being baked.

Assuming that the proper drip has occurred, experience shows that a ventilation of about 1,200 cu.ft. of air per gallon of japan is a safe value (this is equivalent to 1,500 cu.ft. of air per gallon of solvent). Baking in three-fourths to one-hour, most of the solvent is driven off in the first fifteen minutes of the bake, which means that ventilation must be supplied at the rate of



HEAT LOSS THROUGH VARIOUS INSULATING MATERIALS FOR OVEN WALLS

$4 \times 1{,}200 = 4{,}800$ cu.ft. per hour per gallon of japan. Since two-thirds of the solvent vapors are heavier than air, at least two-thirds of the ventilation should be from the bottom of the oven.

The following is a formula which may be used for the calculation of ventilation:

$$\text{Ventilation} = (V \times W \times S \times T) \div 3{,}412 = \text{kilowatt-hours per charge,}$$

where

V = total volume of air required per charge,
W = weight of 1 cu.ft. of air at 50 deg. Fahr. (0.08 lb. approximately),
S = average specific heat of air (23 approximately),
T = temperature increase (450 deg. Fahr. — 50 deg. Fahr. = 400 deg. Fahr.).

From the data sheet, 1.25 gal. of japan is used per charge, which will give $V = 4{,}800 \times 1.25 = 6{,}000$ cu.ft. per hour. Substituting:

$$\text{Ventilation} = (6{,}000 \times 0.08 \times 0.23 \times 400) \div 3{,}412 = 13 \text{ kw.-hr. per hour.}$$

It is found that the average oven should be ventilated to the extent of ten to twenty complete changes of air per hour.

Curves showing the heat insulating qualities of various insulating materials for various temperature differences have been made, with the results shown in the

*Presented at the industrial electric heating conference, Boston, under the auspices of the Power Sales Bureau, New England Division, N. E. L. A.

figure. These results are expressed in heat transmission in B.t.u. per square foot per hour per 1 deg. difference per 1 in. thickness. From these curves it will be noted that "Nonpareil" high-pressure covering has a very low heat transmission value with ordinary temperature differences such as are met in ordinary practice, an average value being 0.4 B.t.u. per square foot per hour per 1 deg. difference between the oven temperature and room temperature per 1 in. thickness; but to provide for losses due to the metal which must necessarily project through the wall 1.0 B.t.u. has been found to be correct.

RADIATION LOSS

The following is the formula which is used for the calculation of radiation or heat transmission through oven walls:

$$\text{Radiation} = (K \times T \times A) \div 3{,}412 = \text{kilowatt-hours per hour,}$$

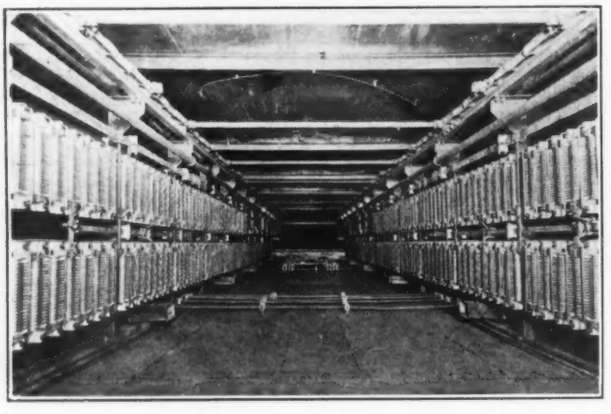
where

K = radiation constant for the wall in question,

T = difference between oven temperature and room temperature (450 deg. Fahr. — 50 deg. Fahr. = 400 deg. Fahr.),

A = total outside surface of oven in square feet.

From the data sheet the oven walls are constructed



CONTINUOUS-CONVEYOR JAPANNING OVEN WITH 180 KW. CONNECTED CAPACITY

of 4-in. "Nonpareil" high-pressure block, which will give the value of K equal to $1.0 \div 4 = 0.25$ B.t.u. per square foot per hour per 1 deg. difference, since the heat transmission varies inversely with the thickness of the wall in almost direct proportion.

The total outside wall surface equals 232 sq.ft. Substituting:

$$\text{Radiation} = (0.25 \times 400 \times 232) \div 3{,}412 = 6.8 \text{ kilowatt-hours per hour.}$$

DOOR LOSS IN TERMS OF RADIATION LOSS

This loss depends primarily upon the cross-section and length of the through metal involved, factors not easily obtained in practice. This loss can be approximated with a fair degree of accuracy by empirical means. While this loss is entirely independent of radiation, it will have probable values in poorly insulated, well mechanically constructed ovens of the box type and of moderate size ranging from 50 per cent of the radiation loss up to 100 per cent of this value for small ovens, while in well-insulated ovens ("Nonpareil" high-pressure block or its equivalent) this loss will probably be from 100 to 150 per cent of the radiation loss. As the oven under consideration is of moderate size and well insulated, we have assumed a door loss value equal to that of radiation loss, namely, 6.8 kw.-hr. per hour.

The following table contains the values obtained above. Each of the above formulas is expressed in kilowatt-hours or kilowatts installed to do the work in one hour, in the first column below; if this work is to be done in forty-five minutes instead of one hour, the kilowatts installed is given in the second column:

	Kw. Rate of Input for One Hour's Bake	Kw. Rate of Input for 45 Minutes' Bake
Absorption	18.3	24.4
Ventilation	13.0	13.0
Radiation	6.8	6.8
Door loss, estimated	6.8	6.8
Total	44.9	51.0

For the forty-five-minute bake the theoretical power consumption in kilowatt-hours is $18.3 + \frac{3}{4}(13 + 6.8 + 6.8) = 38.25$ kw.-hr. This consumption in forty-five minutes requires a theoretical installation of 51.0 kw. It will be obvious, however, that more than 51.0 kw. is required to produce the proper results, for the following reasons: No provision has been made for heating the walls and interior oven constructed during the first charge, nor for the drop in temperature when the doors are opened, because this loss varies greatly with the oven-operating cycle. It depends on the length of time the doors are opened with the corresponding drop in temperature, factors which are so variable that a calculation of this loss would be useless. In every case, in order to secure best results, the material should reach baking temperature before the end of the baking period, which would require a greater demand than that calculated.

The radiation is calculated for a perfect oven, which has not yet been attained by oven manufacturers.

The correct amount of energy to add to the calculated theoretical value is based largely on the knowledge of existing ovens and a careful survey of the oven in question. It is impossible to give a rule that can be followed in every case, but our experience has been that about 15 per cent should be added in every case to the calculated value. The oven in question should have, therefore, 55 kw. to 60 kw. installed, depending upon the heater selected; *i.e.*, the number of heaters required to give balanced heat conditions in the oven with balanced electric circuits.

SELECTION OF VENTILATING EQUIPMENT

The outgoing air from an oven takes with it great quantities of volatile gases which are liable to condense in the ventilating system exterior to the oven. Great care must be taken to see that the ventilating system is kept properly cleaned.

On account of the importance of always getting proper ventilation, it has been decided to recommend a positive ventilation with a motor-driven blower rather than depend on the uncertain ventilation of natural draught.

Under the heading of ventilation, it will be remembered that it is recommended that one-third of the ventilation be taken from the top and two-thirds from the bottom of the oven. As already seen, there will be required a ventilation of 6,000 cu.ft. per hour, and this will require a motor-driven blower with a capacity of at least this amount.

The thermal efficiency of the electric oven is the ratio of the output to the input, in which the output is the theoretical value of absorption and the input the actual

power consumption. The theoretical working efficiency of the oven in question in kilowatt-hours is, therefore:

$$18.3 \div 38.25 = 47.8 \text{ per cent.}$$

This efficiency will result in a baking of

$$1{,}000 \div 38.25 = 26.1 \text{ lb. of japanned material per kilowatt-hour.}$$

In the same way a core-baking problem may be worked out to show how factors such as moisture are taken care of.

Problem.—It is required to determine the energy requirements of an electric core-baking oven baking an 800-lb. charge of core and sand in forty-five minutes; 8 per cent moisture in sand at beginning of bake; 2 per cent moisture in sand at completion of bake; total iron in racks and trucks, 1,050 lb.; 258 sq.ft. outside oven surface.

Substituting in the formula used in the previous problem, with $W = 800$ lb. sand, $S =$ specific heat of sand (0.194), $T = 450$ deg. Fahr. — 50 deg. Fahr. $=$ 400 deg. Fahr.:

$$\text{Absorption sand} = (800 \times 0.194 \times 400) \div 3{,}412 = 18.2 \text{ kw.-hr.}$$

From the information given there is present $0.08 \times 800 = 64$ lb. water, and as the finished core should not contain more than 2 per cent moisture there must be evaporated $0.06 \times 800 = 48$ lb. water.

Approximately 1,200 B.t.u. is required to evaporate a pound of water; hence:

$$\text{Absorption of water} = (1{,}200 \times 48) \div 3{,}412 = 16.9 \text{ kw.-hr.}$$

From the information blank there is present $750 + 300 = 1{,}050$ lb. iron. Therefore:

$$\text{Absorption of iron} = (1{,}050 \times 0.12 \times 400) \div 3{,}412 = 14.7 \text{ kw.-hr.}$$

The ventilation for a core-baking oven should be such that it will keep the oven from smoking, and it is found that about four changes of air per hour are all that is required. This will give a total ventilation of 1,080 cu.ft. per hour, or, substituting in the ventilation formula, there will be found:

$$\text{Ventilation} = (1{,}080 \times 0.08 \times 0.23 \times 400) \div 3{,}412 = 2.3 \text{ kw.-hr. per hour.}$$

The remarks on radiation also apply to this oven, and, substituting in the formula given for a total surface of 258 sq.ft. for the oven in question, there results:

$$\text{Radiation} = (0.25 \times 400 \times 258) \div 3{,}412 = 7.5 \text{ kw.-hr. per hour.}$$

The following table contains the values obtained above:

	Kw. Rate of Input for One Hour's Bake	Kw. Rate of Input for 45 Minutes' Bake
Absorption sand	18.2	24.3
Absorption iron	14.7	19.6
Absorption water	16.9	22.5
Radiation	7.5	7.5
Ventilation	2.3	2.3
Door loss, estimated	7.5	7.5
Total	67.1	83.7

For the forty-five-minute bake the theoretical power consumption in kilowatt-hours is $18.2 + 14.7 + 16.9 + \frac{3}{4}(7.5 + 2.3 + 7.5) = 62.7$ kw.-hr. This consumption will require a theoretical installation of 83.7 kw. We would actually install between 90 kw. and 95 kw., depending on the heater selected.

Too much emphasis cannot be placed on the use of core plates of the least possible weight. Each 100 lb. saving in weight of plates will result in a saving of

$$(100 \times 0.12 \times 400) \div 3{,}412 = 1.4 \text{ kw.-hr. per bake.}$$

As the ventilation of a core-baking oven of this type is not important and as the oven is to be ventilated with only a sufficient amount of air to remove the smoke, natural draught will be sufficient. In this oven the ventilation should approximate 20 cu.ft. per minute.

Since the theoretical absorption of the cores is $18.2 + 16.9 = 35.1$ kw.-hr. and the theoretical oven consumption per bake is 62.7 kw.-hr., the theoretical working efficiency of the oven is, therefore, 35.1 kw.-hr. $\div$ 62.7 kw.-hr. $= 56$ per cent. This efficiency will result in the baking of $800 \div 62.7$ or 12.8 lb. of cores per kilowatt-hour.

Generating Costs in Stations of Medium Size

Southern Station Burning Mexican Fuel Oil Averages 1.37 Cents per Kilowatt-Hour—Another Station with River Washery Coal Averages 1.24

BY M. J. IDAIL
Engineer with Francis R. Weller, Washington, D. C.

DURING recent years of rapidly shifting prices, scarcity and high cost of fuel and difficult labor problems not much information has been forthcoming regarding the cost of generating electrical energy. In the belief, therefore, that engineers and managers in small central-station systems may find generating cost data useful in checking their own costs, tables are offered giving the operating data and costs of two steam-power plants of medium capacity. Plant No. 1 is located in one of the Middle Atlantic States, and plant No. 2 is in the Southern section of the country. Both of these plants are in medium-size communities and pay about the wage scale obtaining in the average plant of the size. These plants are well managed, and every effort is made to operate them as economically as the equipment and conditions permit. The values given in the tables are, with the exception of the peak loads, averages for three-month periods.

The fuel burned in station No. 1 is river "washery" coal (fine particles of anthracite coal). This coal contains about 12,000 B.t.u. and is reasonably free from dirt. The coal has to bear no freight charge to the plant, and during the period covered by the tabulation it cost the company about $2.50 per long ton, delivered. The coal burned during the last part of 1920 was not so good a grade as that used earlier in the year.

TABLE I—GENERATING COSTS OF STATION NO. 1, BURNING RIVER "WASHERY" COAL

	Oct.-Dec., 1919	Jan.-Mar., 1920	April-June, 1920	July-Sept., 1920	Oct.-Dec., 1920
Peak load, kw	860	740	760	720	800
Monthly output, kw.-hr.	263,200	247,900	279,300	250,400	276,000
Load factor, per cent	52	55	55	53	54
Lb. coal per kw.-hr.	6.0	5.5	5.6	5.1	5.3
Operating cost per kw.-hr.:					
Superintendence and wages	0.56	0.60	0.47	0.54	0.46
Fuel	0.73	0.66	0.65	0.60	0.56
Water	0.01	0.02	0.02	0.02	0.01
Lubricants	0.01	0.01	0.01	0.01	0.01
Station supplies and expenses	0.02	0.01	0.02	0.01	0.02
Maintenance cost per kw.-hr.:					
Buildings	.....	.....	0.03	.....	.....
Steam	0.02	0.02	0.01	0.07	0.01
Electric	.....	.....	.....	.....	.....
Total generating cost, cents per kw.-hr.	1.35	1.32	1.21	1.25	1.07

The load on this plant is a combination industrial and lighting load of very good power factor. Throughout the period covered by the table the load was carried on the 937-kva. unit. This unit has a barometric con-

denser which develops a vacuum of 27.5 in. to 28.0 in. (698 mm. to 711 mm.), referred to a 30-in. (760-mm.) column. Prior to April, 1920, steam was supplied from one of the hand-fired boilers, the coal being at that time handled by means of a small industrial car. In April, 1920, the stokered boiler was put in operation, along with a scraper elevator and overhead-bunker coal-handling system and a steam-jet ash conveyor.

Comparing the six months' operation after the installation of the new boiler-room equipment with the previous six months' operation, the percentage reductions in operating costs are as follows:

	Per Cent
Coal per kilowatt-hour	7.0
Superintendence and wages	13.0
Fuel	10.0
Total generating cost	8.0

In this case it is felt that the steam-jet ash conveyor is responsible for the fact that the new equipment does not show a considerably greater reduction than the above in operating cost. The economy of the new installation seems to be on the increase. The total generating cost for December, 1920, was 0.98 cent per kilowatt-hour.

The load on station No. 2 is a very pronounced seasonal load, consisting of lighting and small motors. The months of heaviest load are January, February and March. It is necessary to operate three units over the peaks. Because of warm condensing water it is not possible to maintain a vacuum in excess of 27.2 in. (691 mm.). Mexican fuel oil is burned under the boilers with natural draft.

It will be noted that the fuel equivalent is kept around an average of 3.75 lb. (1.7 kg.) of coal per kilowatt-hour. During the latter part of 1918 this average equivalent reached a value as high as 5 lb.

TABLE II—GENERATING COSTS FOR STATION NO. 2, BURNING MEXICAN FUEL OIL

	Jan.-March, 1919	April-June, 1919	July-Sept., 1919	Oct.-Dec., 1919	Jan.-Mar., 1920	April-June, 1920	July-Aug., 1920
Peak load, kw.	2,185	1,300	1,140	1,800	2,580	1,600	1,275
Monthly output, kw.-hr	567,400	386,100	359,000	491,300	758,000	572,600	452,800
Load factor, per cent	34	40	59	64	62	64	63
Oil per kw.-hr., gal.	.37	.35	.36	.33	.35	.31	.31
Equivalent coal per kw.-hr., lb.	4.0	3.6	3.8	3.3	3.7	3.7	3.5
Operating cost per kw.-hr., cents:							
Superintendence and wages	0.21	0.28	0.29	0.24	0.14	0.23	0.25
Fuel	0.89	0.82	0.91	0.77	0.88	1.05	0.97
Water	0.02	0.01	.....	.....	.....	.....	.....
Lubricants	0.02	0.04	0.04	0.03	0.04	0.02	0.01
Station supplies and expenses	0.02	0.02	0.04	0.02	0.02	0.01	0.02
Maintenance cost per kw.-hr.:							
Buildings	0.01	.....	.....	0.01	0.03	0.01	0.02
Steam	0.12	0.15	0.10	0.07	0.16	0.33	0.03
Electric	.....	.....	0.01	0.01	0.06	0.13	0.02
Miscellaneous	0.01	0.01	.....	.....	.....	.....	.....
Total generating cost, cents per kw.-hr	1.39	1.33	1.39	1.15	1.33	1.78	1.32

(2.3 kg.). With practically the same equipment it was possible, by means of careful instruction and constant direction of the firemen, to reduce the fuel equivalent from 5 lb. to 3.75 lb. For the month of December, 1919, it was 3.2 lb. (1.5 kg.). It may also be noted that as the winter load passed the boilers grew dirty and the pounds of coal increased.

The total generating cost is made high by the excessive and out-of-proportion maintenance charge to steam equipment. This maintenance charge is very largely made up by the maintenance of the two engine-driven units, much piston and cylinder trouble having been experienced.

In determining the coal equivalent of the oil burned the actual B.t.u. content of the total oil burned is converted into terms of pounds of 13,000 B.t.u. coal. The weight and B.t.u. content of the oil has varied somewhat. During the early part of 1919 average values were 7.6 lb. per gallon and 18,500 B.t.u. per pound.

During the period covered by the tabulation fuel oil was purchased at approximately $1.13 per barrel of 42 gal. (159 l.) delivered. With average B.t.u. content and combustion efficiencies, coal would have to be purchased at approximately $4.60 per ton, delivered, in order to equal the fuel costs given in the table. Since the period mentioned oil has increased in price to $2.25 per barrel, delivered.

NATURE OF BOILERS AND GENERATING EQUIPMENT IN STATIONS FOR WHICH COSTS ARE GIVEN

Station	Boiler Equipment	Generating Equipment
No. 1	Three 410-hp. Keeler boilers, operating at 200-lb. pressure and 100 deg. Fahr. superheat; one with hand-fired furnace and other with Coxe chain grate.	One 937-kva. General Electric turbo-generator and one 500-kva. Westinghouse set, both rated at 2,300 volts.
No. 2	Three 335-hp. Erie City boilers; one 400-hp. and one 500-hp. Heine boiler, all operating at 200-lb. pressure and 100 deg. Fahr. superheat.	One 1,250-kva. General Electric turbo-generator and two 880-kva. engine-driven generators, all rated at 2,300 volts.

Generator of 22,000 Kva. Rating for Western Company

ONE of the largest horizontal waterwheel-driven generators ever built has recently been completed for the Great Western Power Company of California. It is a three-phase, 60-cycle machine rated at 22,200 kva., 0.9 power factor, 11,000 volts, 171 r.p.m. There will be two units of this type in the Great Meadow plant on Feather River.

The fact that it was built to operate on a 165,000-volt transmission line, the highest operating voltage to be reached so far in this country, caused some interesting features to be incorporated in its construction. It was designed with special reference to line-charging requirements so that with full-load armature current the transmission-line voltage will not build up to over 80 per cent of the normal voltage. Silicon steel was used in the construction of the armature to minimize core loss. Tests made at the factory on the generator show that it has 97.25 per cent efficiency at full load and unusually high efficiencies at partial loads. These are 95 per cent at half load and 93 per cent at quarter load. All efficiencies were at 0.9 power factor.

The rotor consists of four separate wheels made into a single spider with rim dovetailed to receive the poles. The machine is inclosed for ventilation, having air inlets on each side consisting of ducts coming from underneath. The heated air is expelled into the room. Some of the dimensions are as follows: Total height over all, 21 ft. (6.5 m.); distance over the end shields, about 7 ft. (2.1 m.); distance from the floor line to the top of the machine, 13 ft. (4 m.). The total net weight is 334,000 lb. (151,500 kg.). The machine was built by the General Electric Company and is the largest ever built by that company.

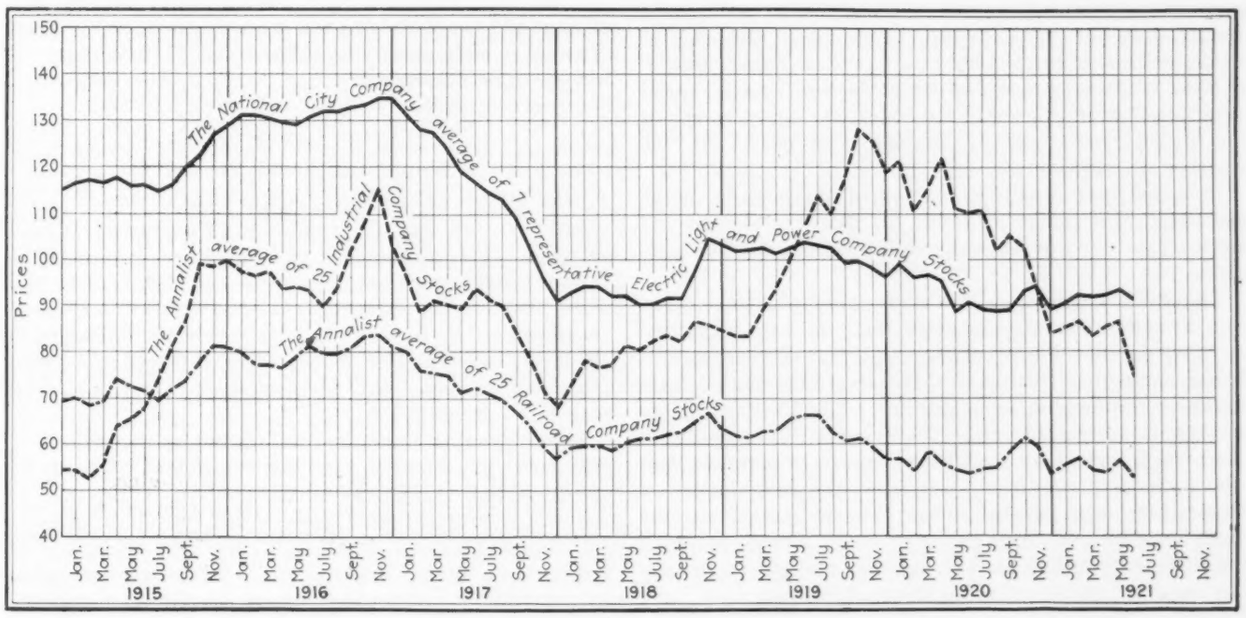
Stability of Electric Light and Power Securities

Average Price of Common Stocks Little Affected by Present Business Depression—Industrials Show Wide Fluctuations

ONE of the essentials of a good security is that it's value shall not be materially affected by conditions existing in other industries. Our industrial and financial structure, however, is so interwoven that absolute immunity from outside effects is impossible; but when an industry such as for instance the electric light and power industry has become part and parcel of our national life, its earnings, both gross and net, fluctuate but little from year to year. Any general industrial or business depression, while it may be reflected in gross returns, does not affect income as adversely as it does the income of some other but less essential primary industries.

stocks have been more stable than the industrial stocks, and practically as stable as the railroad stocks. There is, however, a noticeable downward trend since January, 1913, which became more or less concentrated during the year 1917. This may be accounted for almost entirely by, first, the increasing return demanded for capital, and the resulting fall in value of securities upon which a return is more or less fixed; and, secondly, by the adverse sentimental effect of the present traction situation, rather than any weakness or falling off in the earnings and business of electric light and power companies themselves. Had the electric companies been able to adjust their rate schedules quickly to meet higher operating costs, as is possible in most other primary industries, it is very probable that this downward trend would have been less acute.

If that portion of the curves prior to January, 1918, is eliminated from consideration, the stability of the electric stocks is quite marked, as compared with the curves of industrials, and is found to be within 1 point



AVERAGE PRICES OF ELECTRIC LIGHT AND POWER, INDUSTRIAL AND RAILROAD STOCKS FOR THE PAST SIX AND ONE-HALF YEARS

Through the courtesy of the National City Company we are able to show a chart of the average prices of the common stocks of seven representative electric light and power companies by months for the past six and one-half years. To the diagram have been added curves showing the average prices of twentv-five industrial and an equal number of railroad stocks. The electric light and power stocks represented are of companies doing a purely electric lighting and power business. Companies engaged in more than one utility activity have not been included in the tabulation.

In order that the curves shall be comparable the values plotted have been obtained by averaging the high and low sales of each of the stocks which have occurred during each month.

It will be noticed that the greatest fluctuation in the case of the seven electric stocks for the period of six and a half years was from 89 to 135, a range of 46 points, as compared with a low of the industrial stock of 53 and a high of 128, giving a range of 75 points. The railroad stocks fluctuated from 53 to 84, a range of 31 points. It is, of course, evident that the electric

of the extreme movements experienced by the older and more mature railroad stocks. During this period of three and one-half years the average maximum fluctuation of the electric stocks was 15 points, as compared with 14 points for the railroads, whereas the average of the industrial stocks ranged between 75 and 128, or a total range of 53 points.

It is plainly evident from the curves that electric light and power stocks are much more stable than those of industrial companies. Such a condition is of course to be expected as the earnings of electric companies, both gross and net, per dollar invested, fluctuate but little from year to year, whereas the income of many industrial companies goes from one extreme to another, depending on the general business condition of the country. It is also probable that as the interest rate demanded by the investing public decreases the selling price of electric light and power stocks will rise, and may even exceed the level attained at the close of 1916. The curves indicate that stocks of electric light and power companies have attained an enviable position in the financial world.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Outdoor Meter Installation

To the Editor of the ELECTRICAL WORLD:

SIR: I note in the July issue of the ELECTRICAL WORLD, on page 3, that you advise it is far easier to install a meter on the porch or in some such place where it may be read without the reader meeting the customer at all. There is no question but this practice of back porch installation eliminates a great deal of annoyance and trouble due to customers being away and the inability of the meter reader to secure the meter record. It does, however, present other problems; that is, rapid deterioration of the meter, temperature error, parts of the meter and rotating standards exposed to the weather on periodic tests.

It is my understanding that all of the leading meter manufacturers have objected to the installation of meters that are any way exposed to atmospheric conditions.

The writer some time ago made a personal investigation of several hundred meters that had been installed on back porches for a period of four or five years and found conditions within the meter which caused this company to abandon such practice. I believe that I am correct in stating that at least one commission prohibits the use of meters on back porches. It is possible that where climatic conditions are ideal the installation of meters on back porches would be satisfactory. Our experience and the experience of other companies with which I am familiar shows that this method of installing meters greatly increases the maintenance.

Hodenpyl, Hardy & Company, G. C. LANGDELL.
Jackson, Mich.

Loose Talk on Welding Should Be Stopped

To the Editor of the ELECTRICAL WORLD:

SIR: For the good of the electrical industry some means should be found to eliminate the tremendous amount of loose talk on the subject of electric welding which is at the present and has been for some time prevalent. A great deal of this is the result of ignorance. Part of it is the result of self-seeking by manufacturers or their representatives. I am not, however, referring to the usual line of sales "patter," which is harmless because it is immediately discounted by the prospective buyer.

Arc welding is a wonderful advance in the application of electricity. It has certain limiting characteristics which any one acquainted with the art knows. This fact should be recognized and explained to the prospective user for his own protection, for the protection of the people who buy his product and for the protection of the good name of the electrical industry.

There are at the present time hundreds of proper appliances for arc welding where the process will be very difficult to introduce because some uninformed or misleading enthusiast has made claims which he could not back up and which resulted in disgust on the part of a prospective user. There are some types of machines on the market which are not suitable for arc welding except in certain cases. There are certain jobs of welding which can be done perhaps under certain conditions but in general cannot be done. Add to this fact an ignorant salesman desirous to make a sale at any cost and short-sighted propaganda from his company, and the resulting combination may do immeasurable damage to other manufacturers who are honestly trying to advance the art, to say nothing of the harm done to prospective customers.

I appreciate that this unfortunate condition cannot be rectified in any other way than by proper propaganda. Unless each manufacturer of arc-welding equipment takes it upon himself to see that the claims made by his salesmen or his representatives are the truth, the whole truth and nothing but the truth, present conditions will continue and the sales of all manufacturers of welding equipment will suffer. J. F. LINCOLN,
Lincoln Electric Company, Vice-President.
Cleveland, Ohio.

Would Be World Record

To the Editor of the ELECTRICAL WORLD:

SIR: In the May 14 issue of the ELECTRICAL WORLD, on page 1126, the height of the Ebro Irrigation & Power Company's dam was given as 804 ft. If this were correct, the height would be a world's record. Inasmuch as P. L. Griffith, who was superintendent of electrical construction on the work referred to, differs from you on this point, perhaps some of his comments may be of interest.

He writes: "This must refer to the Camarara development, on which I was superintendent of electrical construction. All my data are in New York, but the following information I believe will be close enough: Development located in the province of Lerida, on the Noguera Pallaresa River; height of dam, approximately 100 m. above riverbed; head on turbines, maximum, 92 m. Two units are now installed of 18,500 hp. each. The ultimate installation will consist of five similar units, total 92,500 hp. Storage reservoir is about 16 km. long.

The four developments of the Ebro Irrigation & Power Company include:

Plant	Capacity, Hp.	Head, (M.)	Units Installed	Units Ultimate
(1) Pobla	4,599	30	Three horizontal	3
(2) Seros	56,000	49	Four vertical	5
(3) Tremp	40,000	68	Four horizontal	4
(4) Camarara	37,000	92	Two vertical	5

We are passing this information along for your records without further comment, but can in no way vouch for the authenticity of the above quoted figures.

Electric Bond & Share Co., W. W. BROWER,
New York. Statistical Department.

[The information presented in the May 14 issue of the ELECTRICAL WORLD was not obtained directly but through a news source. Since that time one of our correspondents has sent us data which we have reason to believe are more authentic. He informs us that the dam is on the Noguera Pallaresa River and is approxi-

mately 295 ft. high. Two out of five ultimate units are in operation, being rated at 11,250 kw. or 14,060 kva., 50 cycles. The ultimate installation will be rated at 70,000 kw. or 87,500 kva. as the machines have been able to carry considerable overload. These figures agree very closely with those given in Mr. Brower's letter.—EDITOR.]

Japanese Law Governing Electrical Operation

To the Editor of the ELECTRICAL WORLD:

SIR: In the May 14 issue of the ELECTRICAL WORLD an article by the writer appeared relating to the procedure of applying for licenses and developing water power in Japan. Possibly some features of the law applying to electrical structures and the operation of public utility corporations in that country may also be of interest. Extracts from the law which deal with these points follow:

VII.—A person engaged in an electric industry [generation, transmission or distribution] may enter the land of another person when it is found necessary to do so for the purpose of making surveys or for the construction of works required in that industry. In cases where it becomes necessary to enter the property of another person approval shall first be secured from the administrative authorities and notice given to the mayor, or the village head man, who shall issue a warrant and have it communicated to the occupant of the land. A person engaged in an electric industry may also obtain admission to the land or buildings of another person in which electric structures have been erected, provided that it is necessary to repair or inspect said electric structures. However, during the period between sunset and sunrise he shall not enter a home or other building in opposition to the wishes of the occupant, except in case of emergency.

VIII.—In case it becomes necessary for a person engaged in an electric industry to cut down trees, bamboos or other plants offering obstacles to the erection of electric structures or to the maintenance thereof, and in case permission of the owner cannot be secured, then the person engaged in the electric industry may cut down or transplant said trees, bamboos or other plants with the permission of the administrative authorities, the fact having previously been reported to the owner. In a case of emergency the person engaged in an electric enterprise may forthwith cut down or transplant said trees, bamboos or other plants, disregarding the foregoing provisions, but the fact shall be reported without delay to the administrative authorities.

IX.—When it becomes necessary for a person engaged in an electric industry to construct an electric line above or underneath ground which has been set aside for public use, such as parks, bridges, ditches, roads, etc., said person may do so with the permission of the superintendent of the property concerned, provided that the construction of such work does not interfere with the utility of said property. For this privilege rent must be paid, as required by the superintendent of the property. If the superintendent or local administrative authorities refuse to grant such permission to the person engaged in an electric industry, or if the rent stipulated by the superintendent is found unreasonable, then said person may apply to the proper minister, who may issue the necessary permit and determine the rate of rent.

X.—A person engaged in an electric industry may construct, if necessary, an electric line above or underneath the ground of another person and may erect on the ground of another the structures supporting the electric wires, provided that no other similar structures are already in existence and also that such construction work does not interfere with the original use of the property by the owner. In case a person engaged in an electric industry intends to use the land of another person in accordance with the foregoing provisions but cannot secure the permission of the owner or occupants of said property, he may commence the work after prescribing the area of property required, provided permission of the local governor shall have first been received. In such cases the fact must be reported to the owner or occupant at least five days prior to the erection of the electric structures.

XI.—In case it becomes necessary to make an alteration in the use of land on or near which an electric line has been constructed in accordance with the provisions of the foregoing article, then the owner or occupant of said land may require the person engaged in the electric industry to remove the electric line or to make such alterations in the electric line as may be necessary to permit the owner or occupant of the property to make the contemplated changes in the use of his land. The cost of the removal of or the alterations to the electric line shall be borne by the person engaged in the electric business, except that it shall be borne by the owner or occupant of the property if the latter fails without proper reason to make the contemplated changes to his property after the removal of or alterations to the electric line have been completed.

XII.—When a person engaged in electric industry enters property of another by virtue of his rights under Articles VII, VIII and X, he shall indemnify the owner or occupant of the property for any loss or damage resulting. The amount of indemnity shall be fixed by the administrative authorities who have granted permission to enter the property. If the owner or occupant of the property is dissatisfied with the decision of the administrative authorities, he may apply to the law court within three months from the date on which such information was received by him. The administrative authorities may require the person engaged in the electric industry to make a deposit, or to give a bond in sufficient amount to cover any possible damages to the property on which electric structures are to be erected.

CHARLES B. HAWLEY.

450 Munsey Building, Washington, D. C.

Electric Resistance of Creosoted Poles

To the Editor of the ELECTRICAL WORLD:

SIR: Believing that there exists in the minds of many linemen a prejudice, based on unnecessary fear, against the use of creosoted poles on lines carrying high-potential or extra-high-potential circuits, and believing also that the use of such poles may aid greatly in solving the pole problem—annually becoming more difficult on account of increasing scarcity of cedar—in 1919 I made inquiry of various managers over the South as to the extent of their use of these poles and as to the difficulties and results they had met.

This inquiry developed great difference of opinion, and further search failed to bring conclusive evidence, especially in regard to the real danger to linemen. I then appealed to the United States Forest Products Laboratory, Madison, Wis., and to the Bureau of Standards, Washington, asking that an investigation be made and its results embodied in a government report on the subject. The replies from these bodies stated that lack of funds prevented taking up the investigation. I found one creosoting company which offered to pay part of the expense of such a government investigation, but no others were found to co-operate. The matter rested here until the recent receipt of a letter from the Forest Products Laboratory asking whether I had been able to get any further information and, if so, that the results be forwarded to the laboratory.

Creosoted poles would be particularly advantageous on street lines carrying 2,300-volt circuits. An authoritative report, such as one by the government, on the resistance of such creosoted poles and the actual degree of danger and inconvenience involved in their use is highly desirable, and I ask if you will not co-operate in urging the government to undertake the investigation.

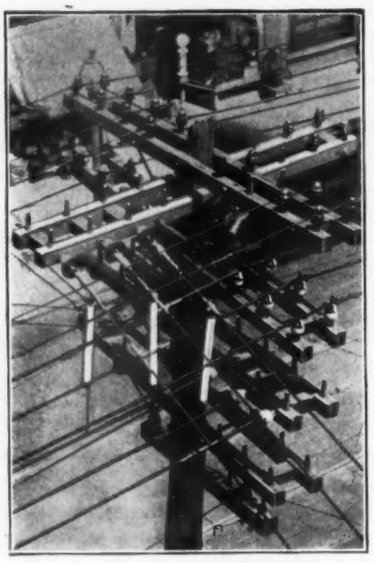
Monroe, La. WALTER G. KIRKPATRICK.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Strengthening a Dead-Ended Circuit

A METHOD of overhead-line construction superseding the old plan of anchoring a dead-ended circuit on pin-type insulators is shown in the accompanying photograph taken on the system of the United Illuminating Company, Bridgeport, Conn. From the pole shown a three-phase, 2,300-volt, 300-hp. circuit is taken off at approximately right angles to the main line to feed the factory of the Bryant Electric Company. The main feed is a No. 4/0 circuit dead-ended on Locke No. 3039 strain insulators bolted through a double cross-arm with guy hooks on the further end and a guy wire to the adjacent pole. The right-angled branch is also dead-ended on strain insulators at the double cross-arm next to the top arm, and the branch is tapped into the main feed through vertical porcelain tubes 2 in. in diameter and 24 in. long. This method costs slightly more to install, according to F. W. Brierly, superintendent of the company, but gives much more satisfactory service. With the older scheme of dead-ending on pins it was found that a No. 4/0 line would cause pin tilting and cross-arm breakage in a short time after installation.



CIRCUITS DEAD-END ON STRAIN INSULATORS

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Economy of 250-Ft. Spans for Rural Lines

THAT some type of construction less expensive than that standardized for urban work is necessary to make farm lines an economic possibility was pointed out in the preliminary report of the committee on rural lines of the Empire State Gas and Electric Association, presented by E. H. Shepard. It is essential that there be no sacrifice of a reasonable factor of safety, that the construction involve a minimum amount of maintenance since it is relatively difficult to reach and that easily obtainable materials be used. It is advantageous to use the same voltage for rural as for urban circuits where practicable, as transformers, insulators and other accessories are thus interchangeable. If it is necessary to use a higher voltage, the choice will depend upon an analysis of the individual case in which the load, the distance and the cost of wire, insulators, transformers, fuses and lightning arresters must all be considered.

On rural lines it will generally be found necessary to string only two or three primary wires of comparatively small size. It is, therefore, possible, so far as the poles are concerned, to increase the span length very materially while keeping the same factor of safety usual in urban construction. It is believed that a span of 250 ft. offers a number of advantages. It may be used for primary line extensions with class B or C poles without sacrifice of the required factor of safety. Using 30-ft. poles and suitable conductors, the necessary clearance to ground can be obtained, and if increased business makes additional wires necessary, such a line can be changed to 125-ft. spans by setting the intervening poles. With 250-ft. construction it is desirable to shorten spans and double-arm poles at sharp corners, and dead ending and guying should be done in a thorough manner.

With the long-span construction it is necessary to use a conductor having a higher elastic limit than the No. 6 copper in common use. There are four materials which have the necessary strength—steel, copper-clad steel and hard or medium-drawn copper wire and steel-cored aluminum cable. Except in cases where the line current is very small and the distance short, the first two materials are unsatisfactory because of their low conductivity, and for general service on long-span rural lines the choice appears to rest between medium-drawn copper wire and steel-cored aluminum cable. There is usually no important price differential between these materials when purchasing wire of equal conductivity.

COST OF ONE MILE OF 2,300-VOLT SINGLE-PHASE LINE, AS OF JUNE, 1921

	— 125-Ft. Spans —		—250-Ft. Spans—	
	No. Items	Cost	No. Items	Cost
30-ft. 6-in. top Western cedar poles, butt-treated	43	$447.20	.....	.....
30-ft. class C Western cedar poles, butt-treated	.....	.....	23	$276.00
Four-pin fir cross-arms with pins and braces	45	45.00	27	27.00
⅝-in x 10-in. galvanized machine bolts	41	4.92	19	2.38
⅝-in. x 14-in. galvanized machine bolts	2	0.31	4	0.62
⅝-in. x 14-in. galvanized double-arm bolts	4	0.65	8	1.30
½-in. x 4-in. lag bolts	45	1.35	27	0.81
6-ft. guy anchors	2	7.12	2	7.12
¼-in. galvanized steel cable, ft.	100	1.00	40	4.00
Three-bolt guy clamps	4	0.96	8	1.92
Strain insulators	2	0.82	6	2.46
Porcelain insulators	90	40.50	54	24.30
No. 6 copper wire, ft.	11,000	221.00	.....	.....
No. 4 triple-braid weatherproof aluminum cable, steel-reinforced	.....	.....	10,800 ft.	212.00
No. 6 aluminum tie wire	.....	.....	200 ft.	
Miscellaneous material	.....	10.00	.....	10.00
Labor and cartage:				
Drawing poles	.....	48.00	.....	32.00
Setting poles	.....	230.00	.....	128.00
Cartage	.....	62.00	.....	40.00
Placing arms	.....	22.50	.....	11.50
Guying	.....	12.00	.....	15.00
Stringing wire	.....	110.00	.....	115.00
Supervision	.....	48.45	.....	34.20
Total labor and material	.....	$1,313.78	.....	$946.11
Overhead expense at 15 per cent	.....	197.07	.....	141.92
Total cost	.....	$1,510.85	.....	$1,088.03
Saving on 250-ft. span	.....	.....	.....	422.82

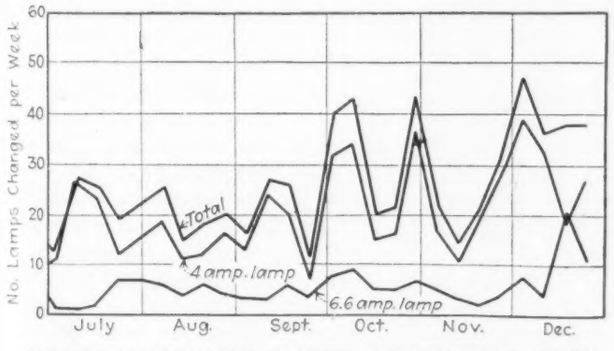
The steel-cored aluminum requires somewhat more care than copper in installation, and the junk value of the copper is proportionately higher than that of steel-cored aluminum. The steel-cored aluminum is, however, much stronger than hard or medium-drawn copper of the same conductivity and is, therefore, better adapted to small sizes for stringing long spans on low supports.

The sag that is recommended for No. 4 aluminum cables steel-reinforced is 52 in. for a 250-ft. span at a temperature of 60 deg. Using 30-ft. poles, clearance to ground at the center of the span will then be about 20 ft. 3 in. Standard N. E. L. A. cross-arms with 1-in. locust pins are suitable for the construction proposed. The use of four-pin cross-arms for two-wire lines or six-pin arms for three-wire or four-wire lines is suggested to obtain ample separation of conductors. Standard galvanized line hardware should be used. The saving to be effected by the proposed construction will vary with different companies, being dependent principally on the material used and the cost of labor. The accompanying tabulation shows the cost of one mile of single-phase, 2,300-volt line of standard construction and one mile of long-span construction on a reasonably straight road, free from trees and when no conflict will be encountered with the construction of other utility companies. It is assumed that both lines are dead-ended at each end. FIELD EDITOR ELECTRICAL WORLD.

New York, N. Y.

Curves Used to Show How Arc Lamps Are Standing Service

IN ORDER to keep track of the condition of arc lamps the distribution department of the Worcester (Mass.) Electric Light Company employs curves showing the number of lamps which are replaced each week. An increase in the number of arc lamps taken out in any week as shown by these curves leads to the conclusion that the arc lamps were not put in proper shape before being installed on the line or that they were handled carelessly by the trimmers. There are two of these curves showing respectively the withdrawals of the ornamental lamp in the special white-way service and the withdrawals for the ordinary street lamps. George



NUMBER OF ARC LAMPS CHANGED FOR REPAIRS OR OTHER PURPOSES SHOWN WEEKLY BY THIS CURVE

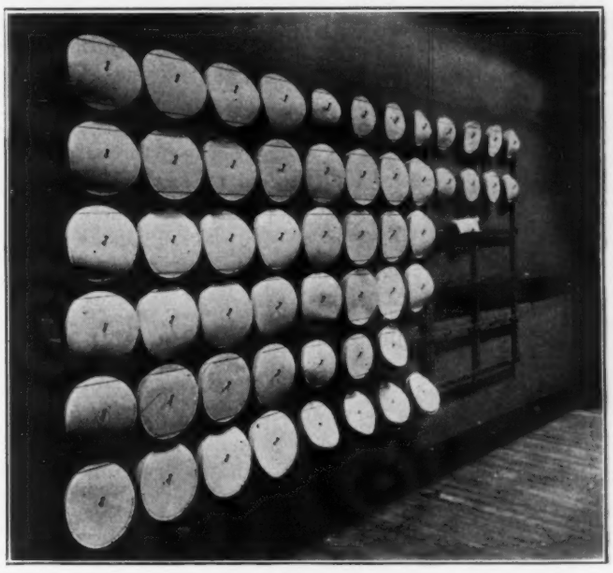
M. Hardy, superintendent of the company, is responsible for the development of these curves.

Similar curves to this are used for many purposes by this company. Some of them have already been published in ELECTRICAL WORLD and more will be published in subsequent issues.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Filing More Than 26,000 Charts on an Open Wall Rack

A CHART rack with a capacity of 26,300 circular record sheets of 10-in. diameter is in service in the offices of the generating department of the Edison Electric Illuminating Company of Boston. The rack holds charts from boiler-room and turbine-room instruments. It is constructed of soft-pine strips, shellacked and fastened together with light screws. Recesses about ⅛ in. deep are cut in the strips where they cross one another to insure a solid structure. The strips are ¼ in. thick by 1½ in. wide and are run 12 in. apart on centers between horizontal rows. The rack is divided into three sections each 4 ft. long, and each of these



COAT HOOKS KEEP THE CHARTS FROM BEING BLOWN AWAY

sections is attached by picture hooks to the molding of the office, the lower portion also being screwed into the wainscoting. The charts, which have holes ½ in. in diameter, are hung on brass coat hooks, of which there are seventy-two fastened to the strips as shown in the accompanying photograph. These hooks cost about $8, but were found superior to inclined wooden pins, off which currents of air would sometimes blow the charts. Each hook will carry 365 charts in order, and thus the exact conditions at any boiler or turbine equipped with recorders can be determined immediately for any time within a year's run without the usual trouble of unearthing such records from stacked-up piles. The cost of rack complete was about $25. R. E. DILLON,

Assistant Superintendent Generating Department.
Edison Electric Illuminating Company,
Boston, Mass.

Holder for Wire Meter Seals

A RECEPTACLE for wire seals in the meter shop usually presents a sad spectacle. The use of a large test clip for holding the seals is convenient, keeping the seals off the floor and in one bunch and allowing one to be taken without disturbing the rest. It is good for one seal or fifty at a time. The terminal screw on the clip is removed and a wood screw used to fasten the clip rigidly to the end of the test bench. Two flat metal hooks prevent side swing. D. A. MCNULTY.

Waterbury, Conn.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Electric Drive for Small Rock Crusher and Pulverizer

THE proper size of motor to install on a small rock crusher and pulverizer and whether a gasoline engine should be used in preference to motor drive were questions which had to be settled recently for a large fertilizer company. To handle the output of a newly acquired quarry this company purchased a rock crusher rated at 1½ tons per hour and a pulverizer of the same rating. The manufacturers of the machines recommended that a 5-hp. motor be used to operate the pulverizer and a 6-hp. motor to run the crusher, making a total of 11 hp. A motor salesman recommended individual operation with a 5-hp., 1,800-r.p.m. motor and a 7½-hp., 900-r.p.m. motor. This, of course, would give satisfactory operation, but, on the other hand, would have entailed a rather high minimum or service charge.

The matter finally came to the engineering department of a public utility. An inspection of the two machines showed the following characteristics: The pulverizer operated at 1,400 r p.m. and having a heavy rotating hammer required a rather high torque to get it up to speed. However, when it was running at full speed the kinetic energy stored up in the revolving pulverizer would aid materially in starting the crusher, and it required considerably less power to keep it in motion than to start it. The pulverizer was equipped with only a tight pulley. The crusher operated at 300 r.p.m. and was equipped with tight and loose pulleys. With this condition the full power of the motor could be utilized for starting the pulverizer, and when this was brought up to speed the crusher could be thrown in and the motor would receive help from the pulverizer in starting it. The engineer accordingly recommended that a 7½-hp., three-phase, 1,800-r.p.m. motor be employed to drive both machines from a counter shaft. The utility company had two phases and a neutral of its three-phase system running past the place, and with this small installation it had agreed to make a "V" connection with the two phases and the neutral rather than insist on the prospective customer paying the expense of carrying the third phase of the system 2,000 ft. to reach his premises. The minimum or service charge for this size motor was approximately $4.50 per month.

A comparison of the cost for a gasoline engine installation was made. The figures were as follows:

Price paid for motor and starting compensator, complete	$150.00
Cost of suspending motor from ceiling	6.00
Total	$156.00
Price asked for the 15-hp. gasoline engine	$285.00
Cost of installing on concrete foundation (estimated)	20.00
Total	$305.00

The difference between cost of gasoline engine and motor installation was $149, and assuming that the installation was not used at all, it would have required thirty-three months for the service charge to dissipate the difference in first cost. Therefore the manufacturer chose the motor drive. The installation was accordingly made, and a test showed that the installation operated satisfactorily and the motor furnished plenty of power for starting and running as the accompanying table shows. The power required was calculated from wattmeter measurements of the input multiplied by the efficiency of the motor.

POWER REQUIRED IN SMALL ROCK CRUSHER AND PULVERIZER INSTALLATION

Both machines rated at 1½ tons of limestone per hour

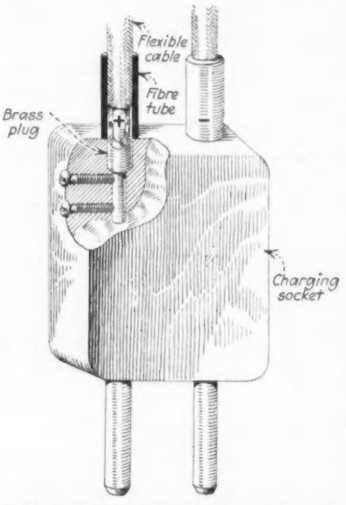
Operation	Power Required, Hp.
Starting pulverizer	6
Driving pulverizer light	2.2
Starting crusher (pulverizer running)	6.5
Driving pulverizer and crusher light	4.15
Driving pulverizer and crusher at full load	6.8

Instances like this are continually coming up which show the value accruing to both the utility and the prospective consumer of competent engineering advice.

Cincinnati, Ohio. A. G. DRURY.

Connectors for Truck-Charging Sockets Save Wires

WHEN charging batteries on industrial trucks a large manufacturing company in the East formerly experienced frequent trouble due to the breaking and short-circuiting of the leads on the charging plugs. The leads must of necessity be stranded to give flexibility, but if the strands are screwed into the plug directly, they soon break and cause a short circuit. By making brass plugs as shown in the drawing to fit in the charging plugs, and soldering in the wire, putting over this a fiber tube, all danger from strands short-circuiting is removed. This was done not only on the charging plugs but also on the plug on the car which fits into the charging socket and is connected to the motor on the truck. Since making this change no trouble has been experienced with leads breaking off and short-circuiting.



BRASS PLUG TAKES PRESSURE OF SCREWS INSTEAD OF STRANDED WIRE

EUSTACE C. SOARES,
Electrical Engineer.
Ophuls, Hill & McCreery,
New York, N. Y.

Lighting a Structural-Steel Plant

FOR lighting the Gage Structural Steel Company's plant at Chicago an illumination design has been worked out which might be applied to other plants of the same general characteristics. This plant starts work at 7 o'clock in the morning and continues until 6 o'clock in the evening. The energy is 60-cycle alternating current, and voltage remains fairly constant at 115 volts.

LIGHTING REQUIRES 0.7 WATT PER SQUARE FOOT

The room which is illustrated in the accompanying photograph has a width of 64 ft., a length of 200 ft. and a height of 30 ft. The walls and the ceiling are both of a dark color.

The lighting installation consists of twenty 500-watt gas-filled lamps hung at a height of 21 ft. above the floor in deep-bowl enameled-steel reflectors. The energy required is 0.7 watt per square foot of floor surface. The equivalent burning hours per month are approximately 75, and the estimated consumption per month is approximately 750 kw.-hr. As the power and light are both on the same meter, the energy consumption could not be measured accurately and the figure given is an estimate.

FIELD EDITOR ELECTRICAL WORLD.

Chicago, Ill.

Motor Troubles Which Show Up as Heating

OVERHEATING of any part of a motor indicates that some trouble is present which must be removed. If there is a full load carried, the frame will probably be quite warm, and with an overload the insulation is likely to smell as if burned owing to the heat carbonizing the cotton braid and shellac. The quickest remedy in such a case is to reduce the load or shut down the motor for a test. If an ammeter is connected in the line, the load is easily determined. A thermometer test, with the bulb imbedded in cotton, will show whether the heat is excessive or not.

Excessive heat may be caused by the armature or rotor striking the poles or stator. In such a case renew the bearing sleeves. Not more than three months should elapse without trying a steel gage between the rotor and the stator of induction motors to determine the clearance, as this may save an untimely shutdown.

When the heat comes from the bearings this is usually due to mechanical friction, such as poor lubrication or a bent shaft, and not to electrical defects. If the heat is from an overload, the fuses may melt repeatedly or the relays may open.

Heat on the commutator of a direct-current motor may be due to heavy friction of the brushes or to flashing over continuously. If the former trouble is found, loosen up on the tension springs. For the latter perhaps shifting the brush rocker arm will eliminate flashing and reduce the heating.

H. S. RICH.

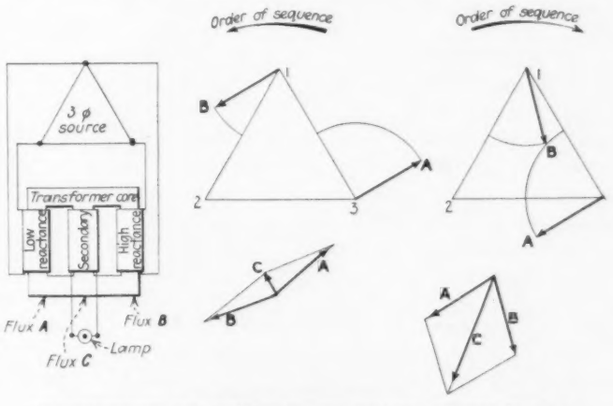
East Berlin, Conn.

Testing for Phase Sequence in Three-Phase Circuits

IN THE interesting article by Prof. F. A. Kartak on "Testing for Phase Rotation in Three-Phase Circuits" which appeared in the ELECTRICAL WORLD for April 23, 1921, four methods of determining phase rotation are classified. A method devised by the writer and which differs materially from the four mentioned in the article will possibly be of interest to those who have to make tests of this nature. This method requires a small polyphase transformer core having two primary windings, one on each of the outside legs, a secondary winding on the common leg and a lamp in the secondary circuit.

The ratio of resistance to reactance in one of the primary coils is made greater than the corresponding ratio in the other primary coil. The flux in the core of the former coil will therefore lag the emf. impressed on that coil by an angle smaller than that by which the flux in the core of the latter coil lags the emf. impressed on that coil. Therefore the resultant flux in the common leg will have a value which is of different magnitude according to the phase rotation of the source, and it follows that the lamp connected in the secondary circuit will have a different brightness.

The electrical connections of the transformer used in this method are shown in the drawing, as are the approximate phase relations of the polyphase emfs. and transformer fluxes for opposite orders of rotation. Vectors 1—2, 2—3 and 3—1 represent the three emfs. of



TRANSFORMER FOR DETERMINING PHASE SEQUENCE OF A THREE-PHASE CIRCUIT

a polyphase circuit. *A* represents the approximate phase of the flux in the core surrounded by the highly reactive coil. *B* represents the approximate phase of the flux in the core surrounded by the coil of lower reactance. *A* lags the corresponding emf. 3—1 by nearly 90 deg. *B* lags emf. 1—2 by about 45 deg. *C* is the resultant flux in the third or common leg.

The effect on the resultant flux caused by different orders of rotation is shown by the two sets of diagrams. The current in the secondary circuit naturally reacts upon the component fluxes so that their lags and magnitudes will not be identical in the two orders. There is no difficulty, however, in so proportioning the windings as to secure the effect desired.

A convenient assembly of the apparatus, including a quick reversing switch, occupies a box 6¼ in. x 4¼ in. x 2½ in. and weighs 3 lb., thus being readily carried in a meterman's kit.

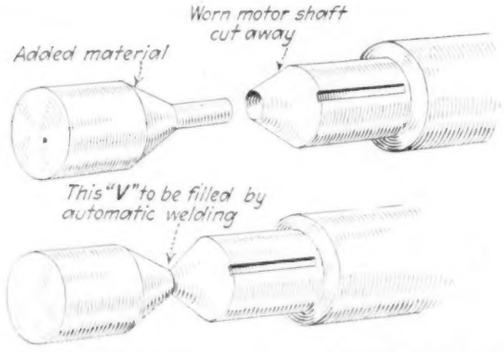
HENRY J. BLAKESLEE.
States Company,
Hartford, Conn.

Motor Shaft Repaired by Auto-Welder Without Removing Winding

A METHOD used for welding ends on motor shafts by means of a steam hammer without removing the motor winding is described on page 830 of the April 9 issue of the ELECTRICAL WORLD. This operation is very easily accomplished by means of the automatic electric arc welder. The end of the armature shaft is tapered to a point and a short drill hole made at the center. The extra material is machined with a taper and with a corresponding projection to line up the two pieces of steel. The projection on the second piece fits into the hole in the shaft end. The shaft is then mounted in a lathe and material is deposited in the groove, thoroughly uniting the two sections. After the groove is filled up the metal may be machined to any desired shape.

In some cases the pulley or gear is not damaged so severely, and it is possible to salvage the shaft by merely building it up without removing any metal. The entire armature and shaft are mounted in the lathe. This application is of considerable value in salvaging street-railway motor shafts where the pinion seat is often damaged, but can be reclaimed by building up the surface above the original size and machining to the proper dimensions.

Owing to the fact that the heat is utilized so efficiently



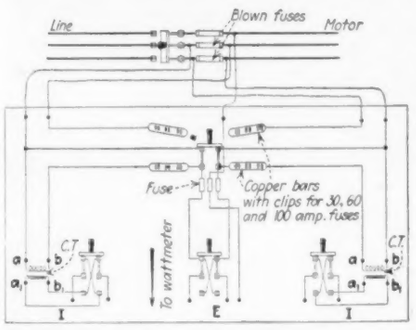
WORN MOTOR SHAFT PREPARED FOR BUILDING UP BY AUTOMATIC WELDING

in the electric arc, it is localized at the point where the welding is being done, and the windings need not be removed in any case from the core, nor need the core or commutator be removed from the shaft. This process has been used on shafts from ¾ in. in diameter up to 26 in. in diameter.

H. L. UNLAND,
Power and Mining Engineering Department.
General Electric Company,
Schenectady, N. Y.

Board for Making Quick Connections When Testing Motors

IN CONNECTING instruments for making a test on motors in an industrial plant, speed in making connections is in most cases a very important factor, and full fuse protection is equally important, because such tests are often made when motors show signs of overload, which means that fuses are needed, and also because of the fact that there are in most cases exposed connections on the wattmeter or current transformers which might cause short circuits. A board which allows quick connection and still has full fuse protection has been developed by the writer. The secondary current connections and the voltage connections are made at one side of the board and are similar to those used on another board described by the writer in the ELECTRICAL WORLD for Sept. 20, 1919, page 658. Each of these sections contains a double-pole, double-throw switch which may be used for checking connections or making power-factor calculations, or reversing leads if desired. In the center of the board is a short-circuiting switch which shunts the current around the current transformers while the motor is being started. This switch is open when readings are taken.



MOTOR NEED BE SHUT DOWN ONLY A SHORT TIME WHILE CONNECTING TEST BOARD INTO CIRCUIT

Connected to the line and to the short-circuiting switch are copper bars, to which are fastened fuse clips of proper size and spacing to take fuses rated at 30-, 60-, 100-amp. The proper-sized fuses are put into these clips, and then connection is made with the motor leads at the motor fuses. In making these connections the writer keeps on hand two blown fuses of every size to be found in the plant, and these fuses are provided with short leads which are connected to the board (as shown in the drawing). The current is then passed around the motor fuse clips to the board and back to the motor line.

When inserting the board in the motor circuit the motor is shut down until the fuses are removed and inserted in the clips on the board. The blown fuses are inserted in place of the regular motor fuses. The short-circuiting switch is closed and the motor is started. A test clip is provided for making a connection to the third wire in the motor circuit, and this connection is disregarded until the motor has been started. This saves some of the time of shutdown.

This particular board, which is 30 in. x 19½ in. in size, has leads 10 ft. long. The motors to be tested range from 1 hp. to 25 hp. and operate on a 440-volt, three-phase circuit. When it is desired to test a motor which is too small to warrant the use of current transformers, the primary leads may be connected directly to the instrument by attaching a to a_1 and b to b_1.

Bullard Machine Tool Company, A. H. PLATT,
Bridgeport, Conn. Chief Electrician.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Personal Contact Makes for Better Public Relations

IN THE report of the public policy committee of the Pacific Coast Division of the National Electric Light Association, of which John A. Britton, vice-president of the Pacific Gas & Electric Company, is chairman, the views of the various power company executives on the Pacific Coast were set forth. Pointing out the necessity for better public relations, the report said: "It is too often the fault of large organizations that the man who, some distance from the head office, is compelled to come into contact with the people and to represent by act and deed the corporation itself is not educated in the policies of the company nor given sufficient authority to speak for and represent the corporation which is served. Thus his position is minimized and of necessity the reputation of the company must suffer. It would seem as if in these days, when an agitated public has a rather critical view of public service corporations and what their activities mean in the development of the particular section which they serve, the company should have as representatives in those sections men who through an intimate knowledge of the company would be able to speak authoritatively upon all questions. The one danger confronting large organizations is the fact that the personal touch of those who have authority to speak is lacking, and it would seem advisable in many cases to try the experiment of having each particular district appeal to the public served in that district as the home company. By such action much misapprehension of the activities of the head office would be cleared away."

Functions and Organization of the Utility Commercial Department

THAT the commercial department should bear the same relation to the public utility company that the selling force does to a manufacturing plant was the contention of W. J. Reagan, commercial manager of the Utica (N. Y.) Gas & Electric Company, in a paper presented before the Commercial Section meeting of the Empire State Gas and Electrical Association held in Cooperstown on June 24. A good commercial department, he said, means more and better pleased customers and the additional load means better operating costs. Discussing the functions, cost, value, organization and methods of this department, Mr. Reagan said:

"In the smaller towns, those of 5,000 or less population, where twenty-four-hour service is available, the problem of promotion of business is essentially different. The community grows but little; the moving-in of a new family marks an epoch; the population has a large proportion of farmers who have moved into town to spend their last years, and the small merchants do a hand-to-mouth business.

"A solicitor, as such, is economically impracticable and unnecessary in a small community. All of the company's employees act as solicitors. The meter reader inquires at each home if the service is satisfactory, leaves a flatiron on thirty days' free trial, suggests a washing machine and hands the mistress a pamphlet descriptive of sewing-machine motors, ironing machines, electrical ranges, toasters, heaters and various other appliances. The bookkeeper tells his grocer, while purchasing merchandise, about the coffee grinder, or to the butcher he explains some late lamp or fixture or suggests a meat chopper. The soliciting is simplicity itself. Every one knows the other fellow's business and talks about his neighbor. The field will never be saturated, for the reason that new time-saving and labor-saving devices are constantly making their appearance.

"The maintenance by the utility of a good stock of lamps and standard appliances, prompt response to trouble calls, generosity in the matter of repairs, wiring on a deferred, small-payment plan, fair treatment and unfailing courtesy—all of these factors contribute to making a market, although every available house and store may be using electric light.

"Wiring Old Houses.—Revenue from new lighting consumers on existing lines will net a higher return, capital invested considered, than any other class of business. The utility company can determine a fair price for the installation of the wiring and call upon the contractor to do the work for this price. The advantage of financing house wiring contracts through local banking institutions, instead of the utility, is more manifest nowadays than formerly, in view of the existing necessity for the conservation of capital.

"The utility company should maintain special solicitors for the work, each having a separate district. Cooperative newspaper advertising can be used, the utility paying one-half and the participating contractors the balance of the cost. Solicitors are paid on the combined salary and commission basis. The costs of the advertising and soliciting will approximate $5 for each contract closed.

"Highway Lighting.—A potential source of revenue exists in the development of adequate lighting systems for state or town highways. Hours of operation may be controlled through time switches or circuit interconnection. Excessive investment for construction in rural line extensions can sometimes be justified when additional revenue can be secured from highway lighting. Records show that accidents are fewer on highways that are well lighted.

"Rural Extensions.—Unceasing and persistent inquiry on the part of farmers and others who are some distance from the terminus of the utility's lines indicates that a definite policy for handling this business must be worked out. Surely the new customer cannot be served at a loss to the utility and the deficit transferred to the existing customers. The utility, therefore, must be willing to serve these prospective customers.

However, an emphatic and direct statement to the customer that 'It must be on a self-sustaining basis' and that he must finance the undertaking is absolutely necessary.

"A definite formula, taking into consideration construction cost, gross earnings and operating ratio, can be worked out in each instance. Placed in the hands of the commercial department, replies can be made to each specific customer, thereby obviating the usual criticism on the part of the applicant of lack of attention to his justifiable inquiry.

"Service to Existing Customers.—Utilities should establish themselves as a source of authoritative information and direction among consumers. Let it be known that within the organization there are trained men who can go to the source of any trouble that may be experienced with the operation of electrical apparatus. The utility maintains a complement of expensive and accurate instruments for research. The service is gratis. In the instance of disputed bills, annoying experiences with motors, etc., this advice from the utility would be heartily welcome. Nothing could be more productive in the interest of mutual satisfaction and a substantial foundation for good will. Well-regulated companies find that 15 to 25 per cent of the total cost of the commercial department is accounted for in furnishing this service to the existing customer.

"If the utility goes into merchandising, it must do so on a business basis, with profit to itself and without competition with the supply dealers. It has been stated that the entire industry is not organized on a basis to carry on a merchandising business. The subject is worthy of considerable thought. Either the utility must organize, educate and assist the local dealers to attain the best results or, as an alternative, it must drop its ultra-conservatism and dignity and adopt red-blooded merchandising methods such as the best organized department or other retail stores employ.

"Repair Service for Appliances.—It is desirable that the utility maintain a repair service for socket appliances. In many communities it is estimated that only 25 per cent of the appliances that have been sold are in service. Unsatisfactory repair service and high cost of repairs are the contributing causes. If the utility establishes a service wherein the only charge made is for the elements or materials furnished, labor being free, the result will be immediate action on the part of the consumer. The actual cost compared with the good will of the consumer and the attendant use of additional electricity is negligible. The free service given should not be confined to appliances sold by the utility. It should be extended also to devices sold by dealers. The opportunity to learn of devices that cause serious trouble, those that are without merit or are defective, and to learn of dealers who do not give reasonable service or whose methods are questionable, is of inestimable value to the utility.

"Advertising Expenditures.—Department stores of recognized standing do not plan to spend more than 2 per cent of the gross receipts per year for advertising. Businesses that are building up must spend as high as 5 per cent. Merchandisers of 'class' and distinction spend 7 per cent. Dealers in electrical appliances are in the latter class. However, they are favored because of the manufacturers' advertising, and the ratio is consequently less.

"If contractors will intelligently apply only 1 per cent of their annual gross receipts to advertising, they can take advantage of every form of co-operative help to the fullest extent and put themselves in the strongest possible position.

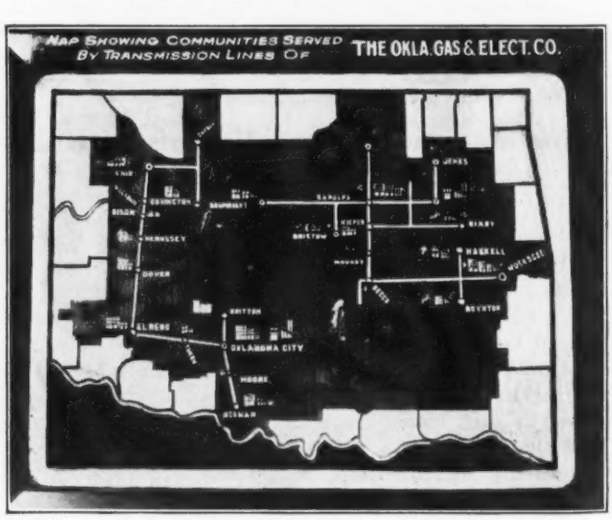
"Cost of New Business.—Expenditures for commercial purposes have been roundly discussed by utility executives. No definite ratio has been established. Some companies are limited as to growth and expansion by local conditions, and in these instances a more conservative policy must be adopted.

"However, there is a definite relation between new-business costs and attendant revenue. Reports of well-managed and long-established companies show a ratio of increase in revenue to commercial department costs with some measure of consistency. Excepting special conditions, it may be stated that in general the increase in revenue should be about four times the cost of obtaining it.

"Assuming that operating expenses, taxes and fixed charges together amount to approximately 75 per cent of the earnings, the remaining 25 per cent may be spent in securing the business. This assertion demonstrates the general principles that a utility can afford to spend its prospective first year's new-business profits to secure the business. This appropriation includes compensation of the commercial department for all effort devoted to service for existing customers. A division of the commercial department budget should be 60 per cent to 65 per cent for salaries of the sales organization, the balance to be expended in advertising."

Electrically Lighted Map to Show Extent of Service

THE Oklahoma Gas & Electric Company is exhibiting in its windows in Oklahoma City and other Oklahoma municipalities served by it a large map illustrating pictorially and geographically the cities, towns, villages and agricultural and oil districts served by the company throughout the state. The sign is electrically lighted for display purposes at night and is a patented affair consisting of a galvanized-iron screen, filled with a composition of which the ingredients are kept secret, shellacked and varnished, with the painting superimposed. It is almost transparent, and the electric lights in the box behind the screen give a brilliant and artistic effect to the painting.



MAP ILLUMINATED SHOWING TERRITORY SERVED

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors, Transformers

Polyphase Series Motors with Brush-Shifting.—F. ERNSTEIN.—General equations are derived for this type of motor, and a circle diagram is developed, from which the usual electric characteristics may be deducted. It is shown which influence the efficiency of the feeding transformer has, and that it is possible to increase the power factor of the motor by improving the efficiency of that transformer. The magnetizing current of the transformer changes the plain series characteristic of such a motor toward the compound type and limits the run-away speed at no-load.—*Revue Générale de l'Electricité*, June 4, 1921.

Lamps and Lighting

Electricity for Steam Locomotive Headlights.—A. H. CANDEE.—The requirements of the Interstate Commerce Commission for locomotive headlights are set down and several types of equipment are discussed to show how they meet these requirements.—*Railway Electrical Engineer*, June, 1921.

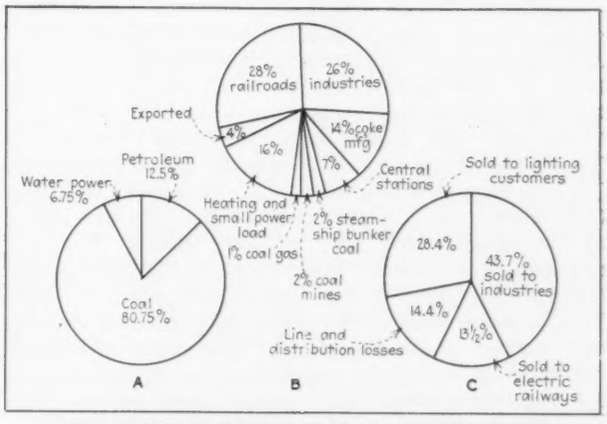
Generation, Transmission and Distribution

Large Hydro-Electric Plants—Tröllhattan Plant in Sweden (1).—A. TETRAL.—The Swedish government owns all water rights on the river Gota between the lake Wenern and the sea coast. The totally available water varies from 320 to 900 cu.m. per second, under a greatest head of 44 m. The present power plant utilizes 250 cu.m. of water per second, developing 80,000 hp. By certain regulations of the lake an ultimate power of 200,000 hp. may be obtained. At present the power house contains fourteen three-phase generators, each driven by a horizontal shaft, double runner, 10,000-hp. turbine at a speed of 187.5 r.p.m. At times of highest water level a head of 30½ m. is available, and the wheels deliver 12,500 hp. The generators are wound for 10,000 volts and give 9,000 kw. at .08 power factor. The machines stand a test voltage of 20,000 volts for fifteen minutes. Under full load a temperature rise of not exceeding 45 deg. C. above ambient air has been guaranteed by the manufacturers (Allmanna Swenska). The regulation of the high voltage is noteworthy, as it is controlled by a booster dynamo, mounted on the shaft of each main generator. The exciter delivers 220 volts and the boosters, which are in series with the excitation buses, give a variable voltage of between plus 110 to minus 220 volts, so that an exciting voltage of from zero to 330 is available. The huge generators have an outside diameter of 7¼ m., a rotor diameter of 4¾ m. and weigh complete about 200 tons. The rotor represents a weight of 60 tons, giving a kinetic energy $\frac{1}{2}MV^2$ of 3.6 million kilogram-meters. A novel ventilating system has been employed, taking air from outside and directing it through the generators. The heated air is used for heating the power plant in winter and is discharged in summer. Three direct-current exciter sets, each driven by a 500-hp. turbine, deliver 220 volts. They are capable of 25 per cent overload. A storage battery of 4,800 amp.-hr. has been installed for emergency.—*L'Electricien*, June 6, 1921.

Survey of Store and Window Lighting.—It is said that a very large percentage of Toronto stores would rank as "bad or medium" according to illumination experts who made a survey in that city.—*Electrical News*, Toronto, June 1, 1921.

Steel Mill Power Factor and the Central Station.—A. K. BUSHMAN and A. L. LEMON.—The author shows that in steel mills the effect of large low-speed main-roll motors is to give a very low power factor at intermittent periods. This is disadvantageous to both the central station and the steel-mill equipment, and automatically controlled synchronous condensers are suggested to remedy both the low power-factor and possible change of voltage.—*General Electric Review*, June, 1921.

Industrial Power Loads.—D. B. RUSHMORE and R. F. EMERSON.—Some data are given showing the approximate amount of coal, water power and petroleum available, with an analysis indicating how this is used in the industries. A discussion of the various load cycles of typical electrically driven machines used in the industries is included.—*General Electric Review*, June, 1921.



DISTRIBUTION OF ENERGY USED IN THE INDUSTRIES

(a) Relative magnitude of the three sources of power on a fuel basis. (b) Distribution of yearly coal production. (c) Distribution of central-station power.

Use of Powdered Fuel Under Steam Boilers.—HARLOW D. SAVAGE.—Commercial installations in power plants are described, together with operating results, tests and comparative costs. Slagging problems are also dealt with.—*Iron Age*, June 2, 1921.

Electrically Heated Steam Boilers.—ERIC A. LOF.—Attention is called to the possibility of the electric boiler where hydro-electric energy is comparatively cheap and combustible fuel correspondingly scarce. An example is given of an installation in a large paper mill

in Sweden where the electric boiler installation consists of seven 2,000-kw. boilers operating at a potential of 10,000 volts and a steam pressure of 10 atmospheres. In this instance there was a saving of the expense of seventeen firemen and all personnel, tonnage and rolling stock otherwise required for the transport reloading and discharging of coal and ashes, amounting to about 65 tons a day. An example is worked out to show that electrical energy should not cost more than about 0.085 cents per kilowatt-hour for ordinary cost of fuel, in order to make this installation economical. Electric boilers using resistance units and also electrodes with which the water itself is the resistor are described by the author.—*General Electric Review*, June, 1921.

Diesel Engines for Driving Generators.—C. S. DARLING.—The author considers construction, operation, maintenance and other problems.—*Beama* (British Electrical and Allied Manufacturers' Association), June, 1921.

Traction

Trackless Trolley Tested at Schenectady.—Tests were recently conducted at Schenectady of a trackless trolley bus built by the General Electric Company for the Virginia Railway & Power Company. The tests were held to be successful. This bus has a seating capacity equivalent to a one-man safety car.—*Electric Railway Journal*, June 18, 1921.

Railway Electrification in Europe.—J. V. DOBSON and F. E. WYNNE.—The authors have set down and elaborated thirty-four points of difference between European practice in electric railways and American.—*Electric Railway Journal*, June 11, 1921.

Trackless Trolley Buses.—E. FINDEIS.—Electrically driven buses connect Vienna with a 2-km. distant suburb, running on pneumatic tires without tracks, fed from a double trolley line, on which rolls a small contact-making carriage, connected with a flexible cable to the car. The length of this cable can be varied, as its end is wound around a take-up drum. Approaching cars have to stop when passing each other, exchange their cables and proceed again. The cars are driven by two motors, built into the rear wheels. They are multipolar, slow-speed, direct-current, 550-volt motors, transmitting their power directly without any gears. The buses accommodate twenty-four passengers, but have carried as many as forty. The empty cars weigh 3.2 tons. The road is very hilly, with a maximum of 8.4 per cent grades. The current consumption is on the average 0.6 kw.-hr. per car kilometer. The line has been in satisfactory operation for thirteen years, a total of 661,000 km. has been covered and over two and a half millions of passengers carried. The cars have suffered badly during the war, as it was necessary to run with wooden tires on account of the rubber shortage.—*Elektrotechnische und Maschinenbau*, May 29, 1921.

Installations, Systems and Appliances

Electrical Exposition at Essen, 1921.—The article is a very well-illustrated account of the more important exhibits of the annual show and comprises short descriptions of, for example, cable connectors, adjustable droplights, hot-air fans, heating pads, general heating apparatus, small motors, alternating-current, direct-current rectifiers (electron tubes type), X-ray apparatus, high-voltage switches (35 kv.), automatic chain-welding machines, motor-operated clamshell buckets, radio apparatus, one-piece stretch-metal poles, etc.—*Elektrotechnische Zeitschrift*, May 26, 1921.

The Control Equipment for the Propelling Machinery of the U. S. S. Tennessee.—M. CORNELIUS.—Emphasis is placed upon reliability, ruggedness and space occupied in the design of this equipment.—*Electric Journal*, June, 1921.

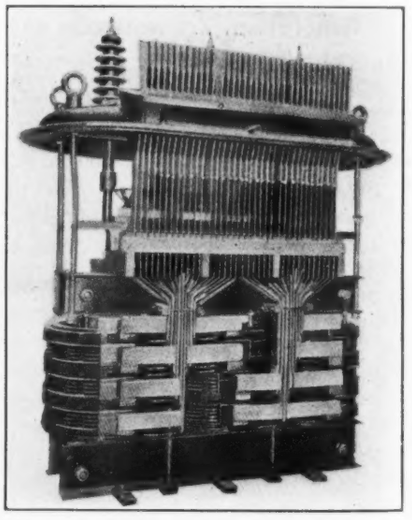
Motor Drive in the Woodworking Industry.—F. H. PENNEY and E. L. BAMFORTH.—It is said that fortunately woodworking machinery commonly demands high-speed motors so that small and inexpensive motors may be applied. Various woodworking machines are described showing the applications of motors as many as nine for one machine.—*General Electric Review*, June, 1921.

The Distributed Capacity of Inductance Coils.—G. BREIT.—A general formula is derived for calculation of effective capacity of a coil. The formula is applied to the short single-layer solenoid and experimental verification is given by direct measurement.—*Physical Review*, June, 1921.

Development of Atomic Theory.—ANDREW NORMAN MELDRUM.—A review of the literature on this subject giving the author's interpretation.—*Publication of Bombay (India) University*, 1921.

Electrochemistry and Batteries

Electrochemical Industries.—JOHN A. SEEDE.—An interesting summary is given of the cost of electric power in the electrochemical production of various materials employing both electrolytic and electrothermic processes. Conversion and transforming apparatus required for this heavy-current service are also described.—*General Electric Review*, June, 1921.



TRANSFORMER FOR HEAVY CURRENT SERVICE

Units, Measurements and Instruments

The Wagner "Earth Connection" in Practice.—G. E. MOORE.—It is said to be quite possible for the electrostatic capacity of a bridge to earth to cause perceptible errors in precision measurements. The type of "earth connection" described is said to insure that the test-bridge remains at earth potential.—*London Electrician*, June 17, 1921.

Directional Measurements with the R. A. F. System.—J. HOLLINGWORTH.—The author describes recent designs of direction finding apparatus and discusses accuracy.—*Radio Review*, London, June, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Crude Petroleum and Fuel Oil Go on Free List

CONSIDERABLE interest is manifested by the electric light and power industry in the action this week of the House of Representatives in over-ruling its committee on ways and means in the matter of a duty on crude petroleum and fuel oil, transferring these items to the free list. A tax of 25 cents a barrel on fuel oil had been proposed.

Quite a few power companies, and especially those on the West Coast, depend almost entirely on oil for fuel and the heavy duty was viewed with considerable alarm. One of the eastern utilities, the Narragansett Electric Lighting Company, uses 900,000 barrels of oil a year. This would mean $225,000 a year additional cost. The power companies argue that if such a duty goes through it must necessarily mean higher rates for oil-burning companies.

Water Supply Reasonably Good in New England

NOTWITHSTANDING the protracted drought which extended through the greater part of June, New England hydro-electric plants are enjoying a fairly good supply of water, especially when considered in relation to existing loads. The Central Maine Power Company, operating plants on the Kennebec and Androscoggin Rivers and tributaries, reported to the ELECTRICAL WORLD on Monday that water conditions in that territory are exceptionally good considering the recent dry period. None of the present load is being carried by steam, and surplus water power is still available. An excellent business, exceeding last year in the first five months comparison, is being handled. The Cumberland County Power & Light Company, Portland, Me., has sufficient water available for the present load and is running no steam plant service, although the prospects are poor for the next two months. There is no shortage of water power on the Androscoggin River at Rumford, Me., and the Rumford Falls Power Company is handling its entire load by hydro-electric energy. Threatened shortages of water in Vermont appear to have been relieved by recent rains.

The New Engalnd Power Company, operating through central New England, and deriving water power from the Connecticut and Deerfield Rivers, reports 40 to 50 per cent steam service during the first half of July, which is rather better than average conditions with this large system. The Turners Falls (Mass.) Power & Electric Company, operating stations in the Connecticut Valley in the Greenfield district, is finding no unusual shortage of water power. The Connecticut Light & Power Company, Waterbury, Conn., is operating about half steam and half water. Last month the water power utilized was about 55 per cent of the average June supply, and this month conditions have improved.

The Burlington (Vt.) Light & Power Company is carrying full load with water power. The Bangor (Me.) Railway & Electric Company, operating plants on the Penobscot and Union Rivers with no steam reserve, is suffering from a prolonged drought, but is carrying its load by the utmost conservation of water and is drawing slightly on storage.

Practicability of Ground Return Circuits Involved in Illinois Case

GROUND return circuits represent the most feasible and economical practice for rural telephone lines, was the testimony of a witness in a case involving inductive interference before the Illinois Commerce Commission on July 13. Locally the case has become known as the Lena case because it concerns the Lena (Ill.) Electric Light & Power Company and some local independent telephone companies. The hearing was held on motion of the commission. Some alleged deficiencies in the construction of both the power and telephone circuits are involved. The case had been postponed several times, it is understood, to permit some of the alleged defects to be cured, and it had been expected that it would be settled without a formal hearing.

The hearing that was finally held on July 13 seems to indicate that the case will be contested on the practicability of ground return telephone circuits and from indications has the possibility of becoming as important as the Homer case. An array of experts, many of whom were concerned with the Homer case, were on hand to watch the proceedings, though they took no active part. The case will come up for further hearing at a later date.

Electrical Industry Must Lead in Return to Prosperity, Says Bump

THE electrical industry must lead in the return to a better feeling and a condition of prosperity in the business world, was the declaration of M. R. Bump, president of the National Electric Light Association, at Cedar Point on Wednesday of last week. If some industry can take the lead all others will follow, and Mr. Bump believes that because the electrical industry has not had to face as serious deflation problems as other industries it is in a position to become the leader that is so urgently needed. That the association headquarters was designed to be the mouthpiece and not the dictator of the central station industry was the view of the activities of the headquarters force that Mr. Bump brought to the Ohio meeting.

Unless the industries concerned can find the right

solution of the inductive interference problem some one else will, was the warning that President-elect McClellan of the American Institute of Electrical Engineers gave in discussion of the situation in Ohio, where a joint committee representing all interests has been formed to draw rules governing both crossings and inductive interference. The Ohio Legislature passed a law at its last session that requires such rules to be promulgated by the utilities commission within six months, and the speaker took the occasion to point out that the situation would reveal the attitude of the utilities toward the law. Rules that will permit progress in giving service to the public are essential and the danger that lies in too hasty standardization and inflexible rules drawn before the problem is really known were called to the attention of the members. S. B. Grace, for the American Telephone & Telegraph Company, said that it must be realized that both industries had to exist and give service not only in the present degree but in a constantly increasing degree. The real solution was indicated as lying in the ability of those interested to get together while plans for contemplated work were yet in the paper stage. The theory of minimum cost to the public of both services was favored by the speaker as a basis for determining what should be done in solving the difficulties. Mr. Grace promised the Ohio people all the information that they asked for regarding the telephone system for use in the study that the joint committee in Ohio is making.

Resolute facing of the problem and the finding of a way of giving service as an alternative of being forced into it by legislative or commission action was urged on the Ohio utilities by D. L. Gaskill in discussing the report of the farm service committee, an abstract of which will be found elsewhere in this issue. An average revenue of $28.40 per year with an average monthly consumption of 14.5 kw.-hr. per month was given by Mr. Gaskill for an analysis of the accounts of one hundred rural consumers on the system of the Greenville Electric Light & Power Company.

The officers elected for the coming year are: President, W. A. Wolls, Columbus; vice-president, E. L. Franklin, Warren; secretary-treasurer, D. L. Gaskill, Greenville.

Sales Managers' Association Meets at Association Island

THE annual convention of the Sales Managers' Association was held on Monday, Tuesday and Wednesday of this week at Association Island, Henderson Harbor, N. Y., with thirty members in attendance, representing the electric light and power companies of Atlanta, Baltimore, Boston, Brooklyn, Chicago, Cincinnati, Cleveland, Detroit, Long Island City, Newark, New York, Philadelphia and Washington. The following program was presented: "Changes in Developments in Electric Sales Quality," R. S. Hale, Boston; "Selling Appliances," E. W. Lloyd, Chicago; "Wiring Old Residences in Cincinnati," F. D. Heed; "Analysis of Electric Conception of Residential Customers," C. A. Barton, Long Island City; "Proper Functions of the Sales Department of a Central Station in Securing Good Public Relations with Its Customers," T. I. Jones, Brooklyn; "Selling Company Securities to Customers," E. W. Lloyd; "Electrical Development Campaign in Cleveland," G. E. Miller; "Some Further Facts and Information in Connection with B 1 Secondary Rates," L. R. Wallace, Boston; "Financing Electric Line Extensions by Customers," R. R. Young, Newark, N. J.; "Large Power Installations," J. D. Noyes, Detroit; "Electric Ice Making and Refrigeration," F. Ennis, New York; and "Actual Experience with Electric Welding," H. T. Luscomb, New York. According to tradition the meetings were held in executive session.

The new executive committee is as follows: R. R. Young, Newark, N. J., chairman; L. R. Wallis, Boston, and H. K. Mohr, Philadelphia.

Celebrate Twentieth Anniversary of Founding of Contractors' Association

MERCHANDISING of electrical appliances still absorbs the attention of electrical contractors and dealers, although there is a tendency on the part of some contractors to give up the sale of appliances and devote their energies exclusively to the contracting business. Although not very general, such a sentiment was manifested at the twenty-first annual convention of the National Association of Electrical Contractors and Dealers at Buffalo this week. It was at the meetings of the national executive committee on Monday and Tuesday that matters of vital importance to the association membership were discussed. These had to do with wiring, cost accounting, cost data, code rules, standard symbols, labor, etc.

The convention also marking the twentieth anniversary of the founding of the association at Buffalo, cognizance was taken of the occasion during the week. Certainly the association, which now possesses 2,320 members, has reason for pride in its record.

Charles L. Eidlitz, the first president of the association, recounted its accomplishments since its inception and all charter members had commemorative badges pinned on them. Past-President W. Creighton Peet was presented with the past-president's emblem and W. L. Goodwin, who received an ovation, was given an illuminated resolution in book form signed by the officers and members of the association in appreciation of the work he has performed for the contractor-dealers of the country.

An admirable address on the business situation was made by Samuel B. Botsford of Buffalo at the opening session. Alfred E. Martin, a banker of South Bend, Ind., spoke on financing the contractor-dealer, emphasizing the need of sufficient capital and knowledge of costs on the part of the contractor in addition to familiarity with the details of his business. He commented on the high cost of selling appliances which needed demonstration and suggested that much of this might be eliminated.

Speaking to the theme of capitalizing your opportunities, W. L. Goodwin made one of his characteristic addresses outlining methods of improving the condition of the contractor-dealer as a merchant and preaching the doctrine of co-operation. He reported that a company has recently been formed to finance contractor-dealers handling certain lines of goods and selling them on the partial-payment plan. The plans of the Society for Electrical Development were also expounded.

One of the most interesting reports presented at the convention was made by the Council on Industrial Relations, headed by L. K. Comstock and J. P. Noonan,

president of the International Brotherhood of Electrical Workers. In translating into action the principles adopted at the Milwaukee convention two years ago approximately 100 cases have thus far been acted on by the council with favorable results. Out of the experience gained it was recommended that electrical contractors withdraw from building trade employers' associations and that local unions sever their connection with building trade councils and that separate and distinct contracts be made for electrical work.

In the estimation of the council the open shop movement has yet to prove its virtues under the newer interpretation of justice by the bigger and broader minds in industry. To avoid misapprehension as to the functions of the council, Mr. Comstock told what it was and what it was not. He characterized it as an agency for promoting harmony, good will and co-operation and said it was not an organization possessing mandatory powers. It sought a peaceful settlement of industrial disputes and not unionization of employees where unions do not exist, or to establish a national wage, or to protect the rights of labor unions or of contractors. Its purpose is to remove the cause of disputes and to do justice between employer and employee so that both may work in perfect tune and accord. Up to the time of going to press no action was taken on the report, which aroused considerable discussion.

Utilities Urged to Make Provisions for Winter Coal Stock

IN ORDER to avoid the unpleasant circumstances that might arise should there be a shortage of coal cars this winter the Interstate Commerce Commission and the Secretary of Commerce have written letters urging the utilities to make arrangements for their winter's coal supply and for adequate reserves. The I. C. C., through Chairman Edgar E. Clark, while appreciating the impracticability of putting into storage an entire winter's supply, suggests the "accumulation now while transportation is easy and cars are idle of a reasonable reserve supply which will help out greatly if and when the pinch comes."

J. W. Lieb, chairman of the joint fuel committee representing the national public utility associations, has brought the letters of Chairman Clark and Secretary Hoover to the attention of the utilities and urges them "to proceed at once to make contracts covering their requirements and replenish their fuel reserves as soon as practicable."

Secretary Hoover's letter and Mr. Lieb's reply are given in full:

MR. J. W. LIEB,
Chairman, General Committee,
Three National Public Utilities Associations,
Edison Building,
New York City.

DEAR SIR:

I would like to call the attention of your association to the bituminous coal outlook. There is every indication that there has been an undue slackness in the purchase of coal which may accumulate to large demands in the autumn. I am convinced that due to the general depression the price of bituminous coal at the mines is not too high at the present time. This is, I think, proved by the fact that numbers of operating coal companies are making no profit whatever. If there should be a recovery of business activities in the autumn, taken in conjunction with the large increase in the percentage of disabled cars (from 5 per cent to 16 per cent during the past six months) and the inability of the railways to finance their maintenance there are possibilities of development of a most serious situation as regards coal movement.

I cannot but feel that the Interstate Commerce Commission in the face of warnings it has sent out in this connection would not be disposed to give any priority in such an event. It seems to me, therefore, to be obvious that the public utilities companies, both in their own interests and the protection of the public, should make early provision for stocks of coal sufficient to carry them over a critical period.

Yours faithfully,
(Signed) HERBERT HOOVER.

HON. HERBERT HOOVER,
Secretary, Department of Commerce,
Washington, D. C.

SIR:

I beg to acknowledge receipt of your letter of July 8 in which you call the attention of the national public utility associations represented by this committee to the early provision by the member companies of these associations of an adequate reserve fuel supply to protect them against the uncertainties of fall and winter deliveries.

We appreciate the timely suggestions contained in your letter and we are glad to lend our hearty co-operation to any efforts in the direction of safeguarding the supply of fuel to public utilities so as to protect the public against the possibility of interference with the continuity of the services which they render.

To this end we have urged that public utility companies if they have not already done so to proceed at once to make contracts covering their requirements and replenish their fuel reserves as soon as practicable.

We are sending a copy of your letter to our affiliated organizations—the National Electric Light Association, the American Gas Association and the American Electric Railway Association—with a request that they send a copy to each member company asking them to give immediate attention to the valued suggestions contained in your letter and co-operate in every possible way so as to avoid congestion of demand and delivery during the early fall and winter.

We deeply appreciate the kind interest which you have taken in calling the attention of public utility companies to this important matter.

Yours very truly,
(Signed) J. W. LIEB,
Chairman Joint Fuel Committee Representing the
National Public Utility Associations.

Italian Commission Returns Home Next Week

AFTER a stay in this country of three months, during which time they visited all of the larger cities and more important electrifications, members of the Italian Commission on Railway and Industrial Electrification will return to Italy on Wednesday of next week on the steamer *Paris*. The commission carries back with it a vivid impression of eagerness on the part of American electrical men to hear of Italian progress and to help the commission secure all the information it desired on American practice. Both the National Electric Light Association and the American Institute of Electrical Engineers took advantage of the opportunity to listen to Prof. Guido Semenza, chairman of the commission, tell of Italian hydro-electric development. Accompanying Professor Semenza on the commission were Prof. C. G. Ponti, who has already returned to Italy; Marquis Ferdinando Cusani and Col. Cesare Scarelli.

Members of the commission were guests of the ELECTRICAL WORLD and *Electric Railway Journal* at lunch at the Engineers' Club, New York, on Monday. Professor Semenza in speaking of Italy's water-powers said that 1,200,000 kw. is now developed, 500,000 kw. is in the construction stage, while plans have been completed and franchises secured for 2,000,000 kw. additional. Work will go forward as soon as proper financial arrangements can be made.

New Thousand-Lamp Street Lighting System for Lima, Ohio

WORK is going ahead on a new street lighting system for Lima, Ohio, to cost $130,000. One thousand standards with 1,000-cp. lamps will be used. The system was designed by G. H. Gamper of Columbus and is being installed by the Northern Electric Company, also of Columbus.

White Way Installation at Oklahoma City Completed

A WHITE WAY lighting system has been installed in the downtown section of Oklahoma City, the first in the city, and plans are under way to enlarge the system so that the entire business section will be included by June, 1922. The present system was put in operation on June 25.

The installation consists of single-light pressed-steel standards with a maximum height of 15 ft. 11 in. The source of light is 14½ in. in diameter with a 112½-in. shaft. Each pole is equipped with auto-transformer for 6.6-amp. circuit and 600-cp., 20-amp. incandescent lamp. Each standard is equipped with a disconnecting pothead and the entire system is supplied with a 20-kw. constant current transformer.

Utilities Should Maintain, but Not Invest in, Rural Lines

RECOMMENDING that no central station invest capital in the construction of rural lines, the Ohio committee on farm service nevertheless recommends that the power companies should maintain the lines when built to obviate the danger of improper maintenance due to the lack of ability of the farmers' organizations to command the necessary skilled help and also because such organizations are usually so faulty that they will not function when repairs are needed to keep the lines even in safe condition. The report was presented before the recent convention of the Ohio Electric Light Association at Cedar Point.

In the construction of the lines the committee recommends that nothing less than 25-ft. 6-in. top poles be used in all cases and recommends No. 6 bare copper wire and stranded conductors at railroad or main telephone line crossings. The committee calls attention to the items of excess cost in this service and says that the number of customers in Ohio rarely averages over five per mile. The cost of the distribution lines is placed at $700 to $1,000 per mile for the labor and material without any engineering or overhead costs. A standard of 6,600 volts for the service is recommended, the report noting that while many 2,300-volt lines are in service, the growing demand will call for lines too long to be successfully handled on the lower voltage.

A rate consisting of a fixed charge covering the excess cost of service plus an energy charge is recommended as fairer than one built up on a large minimum charge. An energy rate with steps downward from the maximum is suggested to encourage the use of ranges and appliances. Transformer and line losses should be charged for at the cost of current at the transformer. Maintenance should be charged for at the rate of 3 per cent per annum if the transformers are maintained by the customer or at 5 per cent if maintained by the company. The extra cost of reading meters is placed at 5 cents per month per customer.

Any method of wholesaling current to farm companies or groups of individuals is strongly condemned. The customers contributing to the cost of the original line should be protected by some plan that will make the later comers bear their share of the cost of the original line, though it is recommended that a time limit of five years be placed on such payments. This figure is used as it is felt it is long enough to prevent the slackers from holding out to get the service for nothing and yet will not prove a serious accounting nuisance to the utilities.

Simplified Rate Schedule for Indianapolis

THE Merchants Heat & Light Company of Indianapolis expects soon to file with the public service commission a simplified schedule of rates, which, according to Charles O'Brien Murphy, vice-president of the company, will mean generally lower rates. The new list of schedules, comprising four different classifications, which are expected to displace the dozen or more various rate schedules in effect, will be filed in compliance with an order of the commission made about a year ago, and will be subject to its approval.

Mr. Murphy classed the new schedules as residence, commercial light and power, optional light and power, and primary power. The maximum residence schedule rate will, if approved by the commission, be 7½ cents per kilowatt-hour. The new commercial light and power schedule rate, he said, will be practically the same as the present "B rate," ranging from 4 to 2 cents per kilowatt-hour.

The third schedule, to be known as the "optional light and power" schedule, Mr. Murphy said, would be figured according to the option of the consumer in selecting a basis of computation, and the new rate charge could, at the consumer's option, be made on a basis of either a total power rate or a total light rate. The fourth schedule, to be known as a "primary power" schedule rate, Mr. Murphy said, would be computed on a basis of two lower steps in energy than supplied at present and would establish rates as low as 1.5 and 2.2 cents.

Senate Gets Metric System Bill

A BILL providing for the compulsory use of the metric system, after a period of ten years, was introduced in the Senate on July 18 by Senator Ladd of North Dakota. The bill is identical with that introduced in the House on April 11 by Representative Britten of Illinois. In connection with the introduction of the bill, Senator Ladd sets forth nine reasons for the use of the system as follows: The 103,000 petitions on file with the Department of Commerce, the petitions of various state legislatures, reporting intention of agricultural group of Senators to support metric legislation, the action of directors of the Chamber of Commerce of the United States in appointing a special metric system committee, indorsements by more than 100 national organizations, the use of the system by most countries, enactment of a metric law by Japan, indorsement by several specified companies, and the fact that certain concerns are manufacturing entirely on a metric basis.

Seven Million Rochester Gas & Electric Issue to Yield 7.35 per Cent

AN ISSUE of $7,000,000 Rochester (N. Y.) Gas & Electric Corporation twenty-five-year 7 per cent bonds are being offered at 96 to yield 7.35 per cent. Proceeds are to be used to take up maturing issues, to provide funds for 80 per cent of cash cost and fair value of improvements, extensions and additions and for other purposes.

Massachusetts Commission Empowered to Regulate Depreciation

AS a result of recommendations of the Massachusetts Department of Public Utilities to the last Legislature, a new law has gone into operation (Ch. 268, Acts of 1921) which places the making of provision for depreciation under the regulative authority of the commission. Gas, electric lighting and most of the electric railways of the state will henceforth be required to set aside depreciation allowances prescribed by the board when, in passing upon rates or security issues, the commission determines that the provision for depreciation has been inadequate. Such moneys set apart from earnings at the order of the board must be kept as a separate fund, and may not, without the further order of the commission, be used for any other purpose than for renewals other than ordinary repairs, or for extensions, reconstructions and enlargements of and additions to plant. The commission is required to prescribe in its order such requirements relative to the creation and maintenance of this fund and its use as may be deemed advisable by the board. To a representative of the ELECTRICAL WORLD Chairman Attwill of the commission said that the law is probably the most satisfactory thus far secured in Massachusetts from the regulatory standpoint, as it empowers the commission to act on behalf of the conservative financial administration of utilities, rendering speculative activities through improper dividend declarations difficult.

Ford and Others Interested in Buying Muscle Shoals Plant

THE Secretary of Commerce revealed on Monday that Henry Ford is not the only private interest considering the Muscle Shoals power proposition. Secretary Hoover stated that various chemical and power companies were considering the matter and indicating an active interest in it.

The Henry Ford proposition, and this has been confirmed at the Department of Commerce, is as follows: Mr. Ford offers to lease for 100 years the Wilson dam and the near-by No. 3 dam, along with the electrical installation, when the project is completed. It is estimated that an additional $28,000,000 must be expended for the completion of the dam. On that sum Mr. Ford proposes to pay interest at the rate of 6 per cent, and to amortize not only this sum but the entire cost of both dams over a period of 100 years. In addition he offers $5,000,000 for the outright purchase of nitrate plant No. 2, its auxiliary steam plant, the land necessary to the operation and other appurtenances. He agrees to operate the nitrate plant for the production of fertilizers and to make the necessary conversion of the plant. He agrees also to maintain the plant so that it may be converted promptly for the manufacture of explosives in case of war. The plant is to be kept up to date. He agrees also to limit the profits of the fertilizer plant to 8 per cent.

Mr. Ford expects to use a part of the power not needed for the nitrate plant for some of his own manufacturing enterprises and in addition it is assumed that he will undertake to find buyers for the surplus power. The Secretary of Commerce authorized the following statement in regard to Mr. Ford's proposal:

"The acceptance of the offer is matter for decision by Congress and that body will no doubt be greatly guided by Secretary Weeks' views in the matter. Mr. Ford has made a genuine proposal. It shows courage to agree to pay out $5,000,000; to spend further sums upon large works and besides to take an annual obligation for about $1,500,000 for 100 years and to agree to maintain a nitrate plant in reserve for the government for that period. Whatever may be the result, Mr. Ford's offer does prove what the public associations have contended—that the completion of this project has a commercial value."

Need Not Advertise Water-Power Applications Until Data Are Complete

THE chief counsel of the Federal Power Commission has ruled, and the commission has approved the ruling, that it is not necessary under the water-power act to advertise applications for licenses or preliminary permits pending the completion of the necessary data, where the applicant has a priority under section 23 of the act.

A. A. E. Directors Meet

FOURTEEN of the sixteen directors of the American Association of Engineers attended the board meeting in Chicago on June 24-25, when plans for the coming year were discussed. Those present were: Top row from left to right—Directors: Charles A. Finley, Pittsburgh; L. E. Ayres, Ann Arbor; W. C. Bolin, Chicago; G. M. Butler, Tucson; E. F. Ayres, Boise; B. A. Bertenshaw, Cincinnati.

Middle row—Directors: W. L. Benham, Kansas City; Morris Bien, Washington; Frederic Bass, Minneapolis; W. E. Vogelback (proxy for Garrison Babcock, Everett, Wash.), Chicago.

Lower row—W. R. McKeen, director, Omaha; Henry W. Clauson, treasurer, Chicago; C. E. Drayer, secretary, Chicago; H. O. Garman, president, Indianapolis; A. N. Johnson, first vice-president, College Park, Md.; A. S. Morris, second vice-president, Chicago.

Florida Company Lowers Rates.—The Daytona (Fla.) Public Service Corporation has put into effect a 1-cent reduction for electric service, as specified in the terms of its franchise granted in 1918, when a clause was inserted providing for a reduction on July 1 of this year. The old rate was 13 cents net. The new rate will be 12 cents per kilowatt-hour net.

Electrification of Oil Fields.—As significant of the possibilities of electric service in the oil fields it is reported that the Drumright division of the Oklahoma Gas & Electric Company now furnishes power for pumping fifteen wells for the Prairie Oil & Gas Company, fifty wells for the Shaffer Oil Refining Company and also furnishes power for the operation of one casing head gasoline plant for the Aurelius Thomas Gasoline Company and one for the Shaffer Oil & Refining Company. The Drumright division has also in immediate prospect power for pumping 100 wells in territory adjacent to its present lines and a number of other casing head gasoline plants.

Receiver Asked for Arkansas Utility.—Suit has been filed in the United States District Court at Little Rock, asking for the appointment of a receiver for the Arkansas Light & Power Company, a corporation operating public utilities in a score or more cities and towns of Arkansas. The company also operates the Citizens Ice & Public Utilities Company of Junction City, Ark. The suit was filed by the Morgan Company of Delaware, a foreign corporation controlled by S. R. Morgan of Little Rock, and the Bank of Fordyce, as trustee. The petition recites that the Junction City company defaulted in payment of $39,140 in bonds and interest held by the Morgan Company, and that the Arkansas Light & Power Company guaranteed payment of the bonds when sold.

Cooking by Magnetic Induction to Be Shown at Chicago Pageant.—George B. Foster of the Commonwealth Edison Company, who is in charge of the electrical industry exhibit at the Chicago Pageant of Progress, has made arrangements with C. H. Thorardson, president of the Thorardson Electric Company, to exhibit a table which cooks foods by magnetic induction. While the device in reality is only a simple application of electrical fundamentals, it is expected that it will prove very interesting to the visitors to the exhibit and will impress on them more strongly than commoner exhibits the scope and usefulness of electricity. The table top contains a number of coils which set up a strong magnetic field about the table. When a cooking vessel of cast aluminum or some other metal of low permeance is brought into the field it heats up quickly and the food it contains is cooked. The table top does not become hot, however, it being possible to keep it covered with cracked ice during the process of cooking, and on this fact depends the interest it is expected to arouse.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Rocky Mountain League Aids Home Builders.—A free advisory service for prospective home builders has been established by the Rocky Mountain Electrical Co-operative League. In this way home builders are assured of expert service in the matter of wiring, fixtures and proper location of outlets.

Connecticut Central Station Changes Name.—The Bristol & Plainville (Conn.) Tramway Company, one of the properties managed by Charles H. Tenney & Company, Boston, Mass., has changed its name to the Bristol & Plainville Electric Company by an act of the Legislature. The headquarters offices are at Bristol.

Central Station and Transmission Line Maps to Be Printed Separately by Geological Survey.—As a result of the reductions made in the appropriations for the U. S. Geological Survey, the plates showing transmission lines and central stations cannot be printed as a part of future water supply papers as had been intended. These plates will be prepared, however, but as separate sheets and as sales publications.

N. E. L. A. Overhead and Prime Movers Reports to Be Published.—By authority of the national executive committee of the National Electric Light Association copies of the overhead systems committee report and of the prime movers committee report, which were presented at the Chicago convention, will be published by the association and made available to members. The price to members of the overhead systems committee report will be $2 and of the prime movers committee report will be $3.50 per copy. Non-members will be able to purchase copies of these reports at a price of $4 and $7 respectively.

St. Louis Still Has $400,000 to Spend on Street Lighting.—Almost $600,000 has been spent so far by the Department of Public Utilities of St. Louis in the manufacture and installation of the new electric street lamps, which have been placed during the last year in every city park and on various isolated streets, according to a statement from Director of Public Utilities Hooke. The report shows that 3,800 concrete lampposts have been manufactured by the city and that of this number about 3,424 poles have been installed with full lighting equipment. The cost for the new electric lighting system is being defrayed from the $1,000,000 "Electric Street Lighting Item" in the recent municipal bond issue. There still remains about $400,000 to be used for further electrification of the St. Louis street lighting system.

Southern Power Authorized to Raise Rates.—Authority to increase its power rates around 20 per cent has been granted the Southern Power Company by the North Carolina Corporation Commission.

Spectacular Lighting for New York Electrical Week.—A number of spectacular lighting effects are planned for the New York Electrical Show, which opens in the 71st Regiment Armory on Sept. 28. Illuminating engineers are now working on plans to flood the tall tower of the armory with light, but just what system of illumination will be used has not yet been decided. It will probably combine certain features of outline illumination such as was used during the Hudson-Fulton celebration; the jewel effects which were developed for the Panama-Pacific Exposition and flood-lighting. A battery of searchlights visible from all parts of the city will top the display. The illumination inside the armory will also be quite different from that customarily employed. The big girders will be hidden by a canvas sky, which will also eliminate the lighting fixtures. Concealed searchlights will throw powerful beams against this sky, and the reflected rays will flood the armory with brilliant illumination.

Associations and Societies

International Association of Municipal Electricians.—The twenty-sixth annual convention will be held at Colorado Springs, Col., Sept. 6 to 10. Clarence R. George, Houston, Tex., is secretary.

Portland Section, A. I. E. E.—At the annual meeting the following officers were elected for the 1921-22 season: Chairman, W. C. Heston; secretary, D. W. Proebstel; executive committee, R. R. Robley and J. E. Yates.

Southeastern Section, N. E. L. A.—The executive committee meeting of the Southeastern Section, National Electric Light Association, was held in Atlanta on July 8. Signal Mountain Inn, Chattanooga, Tenn., was selected as the next convention meeting place and Oct. 18, 19 and 20 was fixed as the date.

Coming Meetings of Electrical and Other Technical Societies

American Physical Society, Pacific Coast Section—Berkeley, Cal., Aug. 4 and 5.
Michigan Electric Light Association—Ottawa Beach, Mich., Aug. 24-25.
N. E. L. A., New England Division—New London, Conn., Sept. 6-9.
Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.
N. E. L. A., Great Lakes Division—French Lick Springs, Sept. 14-16.
Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24.
West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.
Illuminating Engineering Society—Rochester, N. Y., Sept. 26-30.
American Electrochemical Society—Lake Placid Club, N. Y., Sept. 29-Oct. 1.
American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Arriving at Fair Value.—In determining for rate-making purposes the fair value of the Virginia Railway & Power Company, whose territory covers the greater part of tidewater Virginia, including the state's three largest cities, the Virginia State Corporation Commission took the value as of 1914, deducted therefrom approximately what the plant additions in 1914-20 would have represented had they been in place in 1914, added to this the overhead construction cost and then the actual expenditures in 1914-20 for additions to the plant and deducted from this amount the accrued depreciation. A return of 8.18 per cent on the value thus determined was allowed.

North Dakota Commission on Police Power.—The Board of Railroad Commissioners of North Dakota recently made this exposition of police power and contract obligations: "Section 16 of our [state] constitution provides that no law impairing the obligations of contracts shall ever be passed. If the utility act violates this prohibition, it must be void to that extent. But a franchise granted by a city to a utility is an inviolable contract only in so far as the city has power to enter into it, and if the city's power is hedged about with limitations, then the contracts it enters into must also be subject to these limitations. Section 134 of the same constitution provides that the exercise of the police power of the state shall never be abridged. In other words, the state cannot by any statute conferring power upon municipalities deprive itself of those prerogatives known as police powers."

Why Public Utilities Cannot Be Asked to Operate Without Due Profit.—Answering the contention that public utilities should be forced to bear part of the burden resulting from reduced profits that has fallen on industry in general, the California Railroad Commission said in the course of its decision on gas rates to be charged by the Pacific Gas & Electric Company: "The company was not allowed to increase its rate of profit during the war period, but was only allowed sufficient return to maintain approximately its former earnings and continue to render adequate service. The records show that applicant's net profits from its gas business have not increased during the period of high prices, when it is conceded that extra profits were made by industries in general. The utility, being restricted to but a fair and reasonable return during such a period, must, when a change in such conditions occurs reducing the profits in other lines of endeavor, be maintained upon a reasonable basis, as otherwise proper and adequate service cannot be rendered."

Fixing Utility Rates on Basis Proportioned Upon Cost of Oil.—In fixing gas rates for the San Francisco and northern California district the California Railroad Commission established a ratio between the cost of crude oil and the price of gas. This ratio is fixed at from 2 to 3 cents, according to the district, per 1,000 cu.ft. of gas for each variation of 10 cents a barrel in the price of oil. In the Los Angeles district the ratio was fixed at 1 cent per 1,000 cu.ft. for the same variation.

Spencer's 17-Cent Electric Rate Unchanged by Commission Finding.—No present change need be made in the rate of the Spencer (Mass.) Gas Company for electric service, according to a finding of the Massachusetts Department of Public Utilities on June 24. Customers petitioned the board for a reduction in both gas and electric rates and the case was dismissed without prejudice pending the establishment of a new schedule which may embody a service charge. The pre-war maximum rate for electricity was raised from 15 to 17 cents per kilowatt-hour in 1918. The commission found that the company has been maintaining good electric service and that reported interruptions were due to causes beyond the company's lines or else were associated with necessary maintenance of the distribution system.

Cost of Rural Electric Service.—The increase of rates for rural service, the Wisconsin Railroad Commission held in passing upon an application from the Wisconsin Valley Electric Company, "is quite different from authorizing a necessary increase in urban rates. In this case the consumer has made substantial payments for the right to receive service under specified conditions, and ordinarily such refunds as he receives only reimburse him to a slight extent for his expenditure. The business is usually only a very small part of the total business of the utility, and a prohibitive rate on account of an ill-advised extension would result in practical confiscation of the amounts paid toward construction cost." But, the commission adds: "Rural communities must be served, and utilities cannot be expected to take on business which obviously results in a loss. It therefore appears that even though it is necessary to give some consideration to existing agreements, at least during the normal life of the construction paid for by the consumer, this should not prevent a utility from filing and applying rules for future business which will enable rural applicants for service who are willing and able to pay an adequate rate to obtain such service. The resulting temporary discrimination in rates between consumers on old and new extensions is, in our opinion, not an unreasonable discrimination provided the loss to the utility is not shifted to any other portion of its business."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Power Plant Owned by Steam Railroad Not "Used in Its Ordinary Business."—The New Hampshire Supreme Court has found that an electric power plant at Portsmouth owned and operated by the Boston & Maine Railroad is not "property used by a railroad in its ordinary business" and consequently is subject to appraisement and taxation by the city authorities. (112 At. 394.)*

Liability for Bursting of Dam.—In an action by two counties against the owner of a dam which burst and destroyed a bridge (Supervisor and Commissioners of Pickens County, S. C., vs. Jenning), the Supreme Court of North Carolina found that if defendant's negligence co-operated with an unprecedented rainstorm to produce the injury, defendant would be liable if together the two causes were the proximate cause of the damage or if the defendant's negligence alone was the proximate cause. (107 S. E. 312.)

The Human Element in Valuation.—In a decision ordering the Pacific Gas & Electric Company to pay back to its gas customers more than $2,000,000 charged by it in excess of the tariff fixed by the city of San Francisco, the federal district court made these observations on valuation: "The valuation of a plant of this kind is largely a matter of guesswork. Unlike cotton, wheat and other commodities that are bought and sold daily in the market and have an established value, gas plants are seldom sold, and if one should be sold, the selling price offers a poor criterion by which to fix the value of another where the surrounding circumstances may be entirely different. Noted engineers will differ, and differ widely, as to the value of such plants. The difference between the engineers who come before this court so highly commended by the master and by counsel is measured by millions and not by thousands. A difference of 10 per cent in the appraisement or valuation should be accepted as a matter of course rather than as a matter of surprise. The courts have no monopoly in the privilege of appraising or guessing. They must accord the same rights and the same privileges to the Board of Supervisors, and the mere fact that they may differ from the board in their conclusions does not necessarily establish the charge of confiscating property or denying to the citizen the equal protection of the laws."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

A. Hardgrave, re-elected president of the Southwestern Geographic Division of the National Electric Light Association at the Hot Springs meeting, is in charge of the Middle West Utilities properties in the Southwest, with headquarters at Dallas. The Southwestern Division has reached a more complete state of organization than most of the other divisions, due in no small part to Mr. Hardgraves' energy and ability to organize. Mr. Hardgraves has been connected with the Insull interests since 1913 in various capacities and since 1917 has been in charge of the Southwestern properties.

A. HARDGRAVE

A. F. Zacher has resigned as district manager of the Buffalo office of the Economy Fuse & Manufacturing Company.

William M. Eader, Frederick, Md., has been appointed engineer in charge of the municipal electric plant and system.

Harvey Keys has resigned as supervisor of the Electric Shops of the Commonwealth Edison Company, Chicago, to become vice-president and general manager of the Equitable Sales Company of Pittsburgh. Mr. Keys had been with the Commonwealth Edison Company eleven years.

H. H. Porter, of whose accomplishments a biographical appreciation appeared in the July 16 issue of ELECTRICAL WORLD, formed with E. N. Sanderson the engineering firm of Sanderson & Porter not in 1906, as was erroneously stated, but ten years earlier, in 1896.

John H. Lloyd has entered the employ of the government of Panama as electrical engineer of the Department of Public Works.

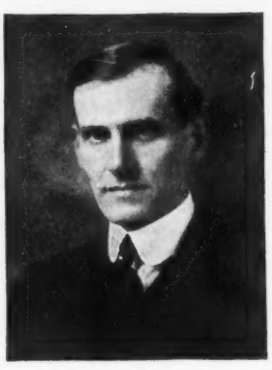
Robert M. Nesbitt has been appointed assistant chief of the electrical department of the Philadelphia Fire Underwriters' Association. He will be associated with Washington Devereux, chief of the department and well known in electrical circles.

Stanley S. Green, who was graduated from the class of 1918 of Purdue University, has been appointed sales manager of the Esterline Meter Company of Indianapolis, Ind. Since March 3, 1920, Mr. Green has been executive secretary of the Purdue Union and active in the raising of $1,000,000 for a new building. Before that he was associated with the Westinghouse Electric & Manufacturing Company, Pittsburgh.

Louis T. Klauder, who recently resigned from the Philadelphia Rapid Transit Company as construction engineer to enter the consulting engineering field, was graduated from the Williamson School in 1901 and from the Drexel Institute in mechanical and electrical engineering in 1908. Mr. Klauder entered the engineering department of the Pennsylvania Iron Works Company in 1901, later resigning to become associated with the Philadelphia Rapid Transit Company in 1905. With the latter company he occupied in turn positions of draftsman, chief draftsman, assistant engineer and construction engineer in charge of plant design and construction. From the last-named position he has just retired in order to devote his entire time to consulting work.

Gustav Clingwald has recently been appointed assistant superintendent of generation of the Southern California Edison Company and will have charge of a number of that company's hydro-electric stations. Mr. Clingwald entered the employ of the Almanna Svenska Elektriska Bolaget of Sweden in 1896. After two years there he was employed by the L. M. Frickson Telephone Company in Stockholm, and later, in 1901, by the De Laval Company in Stockholm. In 1904 he moved to California and was employed by the Southern California Edison Company on construction work. The next year he became assistant station chief of the Kern River No. 1 station, where he remained for nearly ten years, at which time he was promoted to the position of chief of the Mill Creek No. 3 station. In 1919 he was made chief operator of the hydro-electric stations, of which he has recently been placed in charge as assistant superintendent of generation. Mr. Clingwald has a number of inventions to his credit, among which are a long-distance water-level indicator and an automatic water control for use with semi-automatic generating stations.

T. D. Crocker, assistant general manager of the Northern States Power Company, was for the second time re-elected president of the North Central Division of the National Electric Light Association at the recent Duluth meeting. The re-election is a tribute to the fine spirit of co-operation that Mr. Crocker is able to instill into the organizations for which he is responsible. The work of the North Central Division for the past year culminated in an unusually enthusiastic and informative convention, due to his ability in securing the enthusiastic co-operation of all members of the association. Mr. Crocker is a graduate of the State University of Ohio and previous to his connection with the Northern States Power Company was associated with the Milwaukee (Wis.) Electric Railway & Light Company and the Lincoln Electric Company, Cleveland, Ohio.



T. D. CROCKER

Obituary

Gabriel C. Lippmann of the University of Paris and winner of the Nobel prize for physics in 1908 died on board the steamship *France* last week on his way back from the United States. Professor Lippmann was a member of the French commission, headed by Marshal Fayolle, which visited Canada to express France's appreciation of the war service of Canada, and later stopped in this country. He was a world-renowned student of electrophysics and electric measurements. Among his better known works is his principle for the conservation of electricity.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Price Reduction of 10 per Cent Applied to Motors

A GENERAL reduction in prices of motors of 10 per cent was made by manufacturers during the week end of July 9 to 12, and some further changes have just been announced as of July 19. The change affected direct-current motors and polyphase alternating-current motors and motor starting and control apparatus, but did not touch fractional horsepower motors. Single-phase motors of certain manufacturers were also included in the list, but this type was not general. Synchronous motors have been excepted from the cut. This is the second motor price cut this year, the previous one of 10 per cent having taken place early in February.

In addition one prominent manufacturer reports a 10 per cent reduction on transformers of 500-kva. capacity and above and 5 per cent on certain textile motors. Another prominent manufacturer has taken 10 per cent off all direct-current generators and motor-generators.

There seems to be a little better feeling about motor business and from several sources manufacturers find the demand picking up. Inquiries are very heavy in some quarters and more of these are being turned into orders. These orders, however, are small in volume. In fact, motor salesmen and estimators are spending more time than usual on quotations, but the gratifying part of this is that these are breaking a little better. Stocks are good in manufacturers' and distributers' and local district warehouses and virtually all standard sizes and types can be shipped in quick time.

Electrical Material Production for 1919, 1914 and 1909

A PRELIMINARY statement of the 1920 census of manufactures with reference to the manufacturing of electrical machinery and apparatus has been issued by the Bureau of the Census, Department of Commerce. This report is confined to establishments engaged primarily in the manufacture of all kinds of electrical machinery and apparatus during the year 1919.

The figures are based upon the returns from 1,404 establishments, with products valued at $993,280,000. In addition, electrical machinery and apparatus to the value of $21,093,000 were produced as subsidiary products by seventy-nine establishments in other lines of manufacture, making a total value of $1,014,373,000. At the census of 1914 there were 1,030 establishments with products valued at $335,170,000 and ninety-one establishments with subsidiary electrical machinery and apparatus to the value of $24,262,000, a total of $335,170,000. At the census of 1909 there were 142 establishments with subsidiary electrical machinery and apparatus to the value of $18,728,916; total number of establishments is not given, but value is $240,037,479.

There is, however, a considerable production of such commodities by establishments engaged primarily in other lines of manufacture and the general statistics for them are included with those for other branches of industry. In the attached table pertaining to products the total production is given, including that made as a subsidiary product in establishments classed under other industries.

The comparative statistics for 1919, 1914 and 1909 are summarized in the following statement. The figures for 1919 are preliminary and subject to such changes and corrections as may be necessary upon a further examination of the original reports.

The statistics given for the years 1914 and 1909 do not include porcelain electrical supplies manufactured in the clay-working industries, reported by the United States Geological Survey, to the value of $4,130,270 for 1914, nor the value of 10,461,843 dozen globes and 70,211 gross of battery jars accredited to the glass industry.

In comparing statistics at the different censuses allowance should be made, says the report, particularly in the case of some of the less distinctive products, for changes in the schedule of inquiry used, and for the fact that it is possible that all manufacturers did not classify their products in the same way. It is highly probable that many

ELECTRICAL MACHINERY AND APPARATUS—COMPARATIVE SUMMARY FOR 1919, 1914 AND 1909

	1919	1914	1909
Number of establishments	1,483	1,121	.....
Value of products (1)	$1,014,373,000	$359,432,000	$240,037,479
Generating apparatus and parts:			
Direct current	13,142,000(2)	.....	.....
Alternating current	13,127,000(2)	.....	.....
Small dynamos	29,704,000(2)	23,233,000	17,231,804
Self-contained lighting outfits	24,079,000(2)	.....	.....
Parts and supplies	6,214,000(2)	.....	.....
Transformers and feeder potential regulators	31,691,000	13,120,000	8,801,019
Rheostats, controllers and resistances	21,542,000	9,543,000	(7) 2,674,963
Generator voltage regulators	262,000	245,000	(8) .....
Motors (not including starters or controllers)	116,898,000	44,176,000	32,087,482
Electric locomotives	8,161,000	3,721,000	(8) .....
Batteries, storage, dry and liquid	92,506,000	23,402,000	10,612,470
Carbons, lighting, furnace and brushes	13,292,000	3,603,000	1,934,864
Arc lamps, carbon and luminous	607,000	742,000	1,706,959
Searchlights, projectors and focusing lamps	4,342,000	2,082,000	935,874
Incandescent lamps, tungsten, carbon and other	59,372,000	17,350,000	15,714,809
Rectifying apparatus	1,965,000	148,000	(8) .....
Telegraph apparatus, intelligence, police and radio	12,816,000	2,248,000	1,957,432
Telephone apparatus	46,340,000	22,816,000	14,259,357
Apparatus and devices, industrial and household	54,998,000	4,049,000	1,954,112
Electric measuring instruments	19,322,000	8,786,000	7,800,010
Magneto-ignition apparatus, generators, spark plugs and coils	47,389,000	22,261,000	6,092,343
Miscellaneous electrical machinery, apparatus and supplies:			
Switchboards, panelboards and cut-out cabinets for light and power	17,736,000	8,989,000	5,971,804
Railway switches, signals and attachments	4,467,000	6,394,000	5,377,843
Circuit breakers (oil, carbon and air)	4,370,000(3)	.....	.....
Fuses, cut-outs and fuse plugs	7,895,000	1,757,000	1,001,719
Insulators	6,504,000(3)	.....	.....
Sockets, receptacles, bases and attachment plugs	15,636,000	5,513,000	4,521,729
Wiring supplies (current carrier)	6,858,000(4)	.....	.....
Lightning arresters, choke coils, reactors and other protective devices	2,353,000	1,189,000	940,171
Insulated wire and cables	84,217,000	69,506,000	51,624,737
Pole-line hardware	9,379,000(5)	.....	.....
Circuit fittings, not elsewhere provided for	4,908,000	2,068,000	1,080,287
Conduits, underground and interior	19,267,000	4,875,000	5,098,264
Electric lighting fixtures of all kinds	2,718,000	3,384,000	(9) 2,200,668
Annunciators and push buttons	710,000	264,000	235,567
Electric clocks and time mechanisms	1,798,000	411,000	352,513
Bells, buzzers and signal gongs	3,616,000(6)	.....	.....
Therapeutic apparatus	5,482,000	2,653,000	1,107,858
X-ray tubes	3,389,000(3)	.....	.....
All other electrical machinery and apparatus	74,898,000	27,276,000	18,995,176
All other products	89,643,000	23,628,000	17,765,645
Amount received for custom work and repairing	30,760,000(3)	.....	.....

(1) Includes electrical machinery and apparatus valued at $21,093,000 reported as subsidiary products by seventy-nine establishments engaged primarily in other industries in 1919, compared with $24,262,000 by ninety-one establishments in 1914 and with $18,728,916 by 142 establishments in 1909.
(2) Included with dynamos in 1914 and 1909.
(3) Included with all other electrical machinery in 1914 and 1909.
(4) Included with electric light fixtures in 1914 and 1909.
(5) Included with circuit fittings in 1914 and 1909.
(6) Included with annunciators in 1914 and 1909.
(7) Rheostats and resistances only.
(8) Figures not available.
(9) Not including fixtures made by establishments engaged primarily in the manufacture of "gas and electric fixtures."

articles specifically called for were not reported separately and are included in the item "all other electrical machinery, apparatus and supplies."

Present Conduit Prices Same as Those in January, 1917

WITH the announcement last week of lower base pipe drops and the resulting downward price revisions in electrical conduit, the conduit manufacturers are again on a price basis the same as that which went into effect on Jan. 2, 1917. The card generally in effect now is No. 47, dated July 11, carrying a discount of 41 per cent on ½-in. black and 35 per cent on ½-in. white conduit in carload quantities.

Electrical conduit went on the Pittsburgh basing plan with card No. 1 in August of 1913, and according to the cards of a representative manufacturer the low point in price was reached in October, 1914, when ½-in. black carried a discount of 73 per cent and white 69 per cent in carloads. The discounts gradually diminished from that time until they touched a low spot of 21 and 15 respectively in May, 1917, at which time conduit prices from the manufacturer were the highest. The price gradually decreased until March, 1919—30 per cent on ½-in. black and 24 per cent on white—returned 3 points in February, 1920, and decreased again in steps, starting January, 1921, to the present level.

There have been three price decreases this year for a total of 14 points on the ½-in. size in carloads.

Industrial building work generally is at a relatively low level throughout the country and consequently the demand for conduit is low. Still reports are received this week which show a fairly satisfactory demand for ½-in. black pipe in St. Louis, a little more activity in demand for galvanized from textile mills in the Southeast, a steady demand for ½-in. black in Chicago and a slightly better demand for small sizes of pipe from certain jobbers in New York. It cannot be expected that any prominent demand will be experienced, however, until there is more activity in commercial and industrial building than there is at present. But pipe prices are on a level now comparable to that effective January, 1917.

Porcelain Insulator Prices Reduced from 5 to 10 per Cent

EFFECTIVE July 15 and 18 in different instances several manufacturers of high-tension porcelain insulators have announced lower prices. On suspension types the cut amounts to 5 per cent, while on all others it is 10 per cent. Included in this drop are some of the insulator hardware items. Standard wiring porcelain was also reduced, in a representative instance, the discount being increased 8½ points, except on short tubes where it was 3½ points.

This is the second price decrease to be made on high-tension insulators. The first, amounting to 10 per cent, occurred during the last half of February but it did not cover single-part pin-type insulators. Demand shows considerable falling off since the first of the year, it is stated. At the present time, though there is a fair number of orders being received from central stations, they are small in size and both the foreign and domestic markets shape up as quiet. Electric railways up to the present time have taken little or no interest in the market.

Production is still at full capacity throughout the industry, however, but as deliveries are being made faster than orders are received, it is a question just how long this will hold true. One of the large producers, for instance, has enough business on hand to keep going full time for two months, though it is admitted there is not a whole lot in sight after that time. Deliveries have been steadily improving and now range from about four to six weeks on suspension types and four to eight weeks on pin-type insulators, depending upon the voltage. No stock has yet been accumulated on the high-tension types, but on low and medium voltages there has been some accumulation of stocks.

Pole Line Hardware Prices Show Cut of 2½ to 7½ per Cent

PRICES on pole-line hardware are again down. This time the cut ranges from about 2½ to 7½ per cent in a number of instances, and was made on varying dates from the first to the fifteenth of July. Lower costs on steel are said to be responsible for this latest drop. At least three other general price reductions have been reported in the galvanized line hardware field since the first of the year, and in some instances four decreases. The first cut of 5 to 15 per cent was made in late December and early January, the second of 5 to 7½ per cent occurred on Feb. 15, and the third reduction, amounting to 7½ to 10 per cent, was effective on April 11. Early in June at least one manufacturer and a manufacturer's distributer made a fourth decrease of 5 per cent, so that with this latest drop prices are well down. Demand has just recently started to show a slight improvement, it is reported, though factory stocks are still quite large.

A representative distributer's prices on various items per 100, f.o.b. Chicago, are as follows: Carriage bolts, ⅜ in. x 4½ in., $1.93; crossarm braces, 1¼ in. x ¼ in. x 28 in., $13.19; lag screws, ½ in. x 4 in., $3.33, and machine bolts, ⅝ in. x 12 in., $8.95.

The Metal Market Situation

THE present position of the copper market is not very encouraging. Prices have receded about ¼ cent per pound in the major market on all positions and from ⅛ to ⅜ cent in the outside market within the past week. Domestic demand is no better and export sales are lacking. Despite the fact that forty-two out of fifty large copper producing companies are not operating right now, surplus stocks are still too large to afford much comfort. Large producers are not pressing to sell, however, and are unwilling to shade 12.75 cents per pound delivered for July and August or 12⅞ cents for third quarter delivery. Small producers will sell these positions at 12½ and 12⅝ cents delivered. Bare copper wire base has declined to 14.25-14.75 cents.

In a special study on the German copper market made by *Engineering and Mining Journal* it seems that Germany has lately been the chief support to export copper trade. And Germany pays cash for copper purchased in the United States, while France and England, the two next important users of United States copper, and other countries have been and are still able to take advantage of the liberal credit terms advanced by the Copper Export Association. With official peace declarations consummated it is possible Germany too will seek credit extensions.

The Aluminum Company reduced its prices 3½ cents per pound on July 15. Lead holds its own and shapes up better as to demand than other non-ferrous metals. Demand for zinc is dull and the current output small. Prices have receded a fraction of a cent. Tin is down still further and the cheapness of this metal is attracting some inquiries. The scrap metals market as a whole shows little improvement. Heavy copper scrap, for which there is a fairly good demand, shows a slight increase, while brass holds its own.

NEW YORK METAL MARKET PRICE

	July 12, 1921	July 19, 1921
Copper	£ s d	£ s d
London, standard spot	72 0 0	70 2 6
	Cents per Pound	Cents per Pound
Prime Lake	12.87½—13.00	12.75
Electrolytic	12.75—13.00	12.50—12.75
Casting	11.75—11.87½	11.75
Wire base	15.00—15.25	14.25—14.75
Lead, trust price	4.40	4.40
Antimony	4.65	4.65
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	4.80	4.70—4.75
Tin	28.37½	27.00
Aluminum, 98 to 99 per cent	28.00	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50—9.75	9.50—10.00
Brass, heavy	4.25—4.50	4.25—4.50
Brass, light	3.50—3.75	3.50—3.75
Lead, heavy	3.37½—3.50	3.25—3.37½
Zinc, old scrap	2.00—2.25	2.00—2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

FANS still continue the chief item of activity in the electrical supply line, although in the Southeast, St. Louis and Chicago territories pipe shows fair activity. General supply business, however, is only holding its own. Here and there is noted a little action on various items, but these are strictly localized. Collections remain unchanged.

Lower prices are ruling this week on motors and control equipment, wiring and high-tension porcelain, pipe and line hardware. Lower prices on schedule material and heating appliances have helped sales in Portland and Intermountain territories.

In the Southeast refrigeration is active and the fruit crops are very good; St. Louis is going through an electrician's strike; building is proceeding well in Chicago, although no settlement of the labor dispute has been made; textiles are quite strong in New England and metal trades slow; crop conditions are better in the Intermountain and Northwest districts.

NEW YORK

Business drags along on the same level with little if any improvement. Fans are active, but that is about all. Residence building in sections such as Long Island is aiding conduit to move with some jobbers, but this is not general. Cuts on heating appliances have not stimulated demand. The armored-conductor market is in a deplorable condition, with prices cut right and left. Panel boxes are down about 10 per cent—another item to feel the effect of the steel price drop. Standard wiring porcelain is also lower by nearly the same amount. Collections show no change.

Industrials within the past two weeks have shown increased signs of life. Business placed by the latter is no larger individually, but there is an increase in the number of orders received, which is regarded as a very hopeful sign. One of the large manufacturers of motors reports that resale orders on behalf of both fractional horsepower sizes for drink mixers, vacuum cleaners, etc., and larger motors going into power machinery are picking up slightly.

Panel Boxes.—Though in at least one instance a price decrease of 10 per cent will not officially be made until July 25, other manufacturers are at the present time quoting prices down to this extent following the recent steel cut. The reduction from peak quotations amounts to 40 to 50 per cent. Manufacturers report a light demand with good stocks.

Conduit.—Prices in 2,500-ft. lots are as follows: black, ½-in., $57.80 to $62.02; ¾-in., $74.70 to $80.63; 1-in., $107 to $115.96; galvanized, same sizes, $62.90 to $66.87; $81.55 to $87.19; $117 to $125.65. Stocks are good but despite the report of some jobbers that sales are better for residence building in outlying sections, general demand is light.

Flexible Armored Conductor.—The market is in a weak condition with prices shot to pieces. As low as $48.50 per 1,000 ft. in that quantity is quoted on No. 14, two-wire, double-strip by a large jobber this week, and some prices are even lower.

Tape.—Demand for friction is fair with a price in 100-lb. lots of 33 to 42 cents per lb. Sales of rubber are slightly less with a prevailing price of 33½ to 44 cents. Stocks of both kinds are good.

Rubber-Covered Wire.—Sales are light, with more than adequate stocks held. No. 14 single-braid, 10,000-ft. lots, brings $6.50 to $6.77 per 1,000 ft.

Porcelain.—General price decreases were made by manufacturers on standard wiring porcelain early last week. The drop ranged from about 4 to 10 per cent. Jobbers are quoting 60 per cent discount in barrel lots but demand is light.

Fuses.—In standard package quantities N. E. C. non-renewable 30-amp. fuses bring 7 to 10½ cents each net, and plug fuses from $3.38 to $4 per 100. A standard 30-amp. renewable fuse sells for 26 cents each with a contract and 30 cents without a contract. The supply is plentiful and stocks are moving fairly well.

Sockets.—On pull sockets listing at 60 cents each, keys at 33 cents and keyless at 30 cents, jobbers quote 24 and 25 per cent discount in standard packages. Jobbers' stocks are well supplied but the demand is spotty though better than before the recent price drop.

Fans.—Sales have dropped slightly as the weather has not quite held up its hot pace, but the general demand is good. The best sellers are 16-in., 12-in., and 9-in. oscillators.

Heating Appliances.—The general report is that recent price decreases have stimulated little if any business though some jobbers report a fair demand for 6-lb. irons. Two well-known makes now list for $6.95 and $7 each, a drop of about a dollar, and take 30 per cent discount in quantities up to six.

CHICAGO

Despite the unsettled labor controversy the initiation of new building in Chicago is proceeding at a lively pace. The ten-year average of permits issued is $1,620,000 per week. During the eight weeks before the selection of an arbitrator new permits were down to an average of $600,000 per week, but immediately thereafter they jumped and since then have averaged $1,750,000 per week. When it is considered that very little industrial work is included in this current total and that it is made up almost exclusively of small residence and apartment jobs it can be seen that whenever the break for prosperity does occur there should be an immense amount of construction work.

Current transactions in the electrical trade, except in hot weather goods and for the above construction, are limited to routine requirements. Price changes are negligible and when they do occur they seem to have no effect on trade, as buying is done only when an actual need exists. Collections remain slow, but no new features have developed which would cause any alarm.

Bare Copper Wire.—Except for filling seasonal replacement needs trading is absent and the price remains unchanged. Most purchases are for relatively small lots and quotations thereon are firmly held. On large quantities prices are open to negotiation. Quoted price remains 16½ cents per lb. on No. 8 in 1,000-lb. lots.

Rubber Covered Wire.—Under light demand thirty-day stocks are being maintained by most handlers. Current quotation for No. 14 in 10,000-ft. lots is $7 per 1,000 ft.

Flexible Armored Conductor.—Price remains $57.50 per 1,000 ft. for No. 14 two-wire, double-strip. There is a steady demand of small volume for this material for current building operations. Stocks are normal and a shortage is possible should consumption increase rapidly.

Black Conduit.—A steady demand continues for black pipe, particularly in the ½-in. size, which is quoted at $59 per 1,000 ft. in 1,000-lb. lots.

Fans.—Demand continues excellent as the heat continues of real summer variety. Retailers and jobbers alike are unable to supply the demand, which is heaviest for household sizes. The 12-in. fan is the one most wanted, although large quantities of 6 and 8-in. are finding distribution.

Heating Appliances.—Summer demand is excellent and the current habit of maintaining low stocks has resulted in much back ordering. Prices are firm, with but little complaint heard of their being too high. Sales run to the smaller and lower-priced items.

Washing Machines.—This trade seems to have fallen off to a certain extent, probably largely due to reduced sales effort during the vacation season, as no reports are heard of campaigns failing.

BOSTON

Trade shows no marked improvement as yet, but underlying conditions continue in the main to strengthen. Business in Maine is holding up remarkably well and in textile centers many mills are operating well up toward their capacity. Metal-working industries are very dull. A gradual increase in the number of building construction jobs being handled can be seen in some quarters of New England, although the total of contracts for building and engineering construction placed in the week ended July 12 in this section was only $1,569,500. Prices softened considerably during the past week, with reductions in motor and control equipment, pole-line hardware, porcelain tubes, unglazed cleats and rigid conduit. Jobbers are buying from hand to mouth and retailers are moving cautiously in replenishing stocks. Collections are very closely watched, but underlying financial conditions tend to improve slowly.

Motors.—Prices on a number of leading makes of motor and control apparatus were reduced about 10 per cent during the past week. It is easy to secure prompt shipments on virtually all standard lines at present. Buying is still very spasmodic, but small power users are never out of the market, and the demand for quotations is diversified and distinctly encouraging.

Flexible Armored Conductor.—Slow movement is reported. No. 14 single-strip sold Monday from $50 to $55 per 1,000 ft., depending on size of orders. In 1,000-ft. lots the $55 figure obtains quite generally.

Porcelain Fittings.—Easier prices on some material of this class are in effect. Nail-it knobs now sell at $19 per 1,000 in barrel lots. Unglazed cleats are down to $16.25 per 1,000 in barrel lots from about $24, and 3-in. x $\frac{5}{16}$-in. tubes are now $7.05 per 1,000 in barrel lots. Some small-scale buying of these materials is under way and shipments are good.

Fans.—Last week an active movement of fans took place in Boston, although distributers' stocks were not cleaned out by any means.

Non-Metallic Flexible Conduit.—This material is more active than most other wiring supplies. Stocks are ample and the $\frac{7}{32}$-in. size is selling around $22 per 1,000 ft. in 1,000-ft. lots.

Wire.—Rubber-covered wire is in moderate demand. No. 14 is selling from $6.25 to $6.50 per 1,000 ft. in lots of 5,000 ft. and under, with considerable instability on the sale of larger quantities. Weatherproof wire, on a 15-cent base, is moving slowly. Bare wire is in very light demand, with a 14½-cent base quoted. Central-station buying while not heavy is fairly good considering the conservatism followed in regard to extensions.

Flashlamps.—Trade is brisk, largely owing to seasonal movement and to energetic marketing methods. New designs are appealing to the trade.

Line Hardware.—Reductions of the order of 10 per cent occurred within the past week. The market is rather dull, but piecemeal line construction is absorbing some of this material.

Small Socket Appliances.—Well-distributed orders, including a good many "repeats," are being received from small dealers in this territory.

Washing Machines.—Prices on a leading make have been marked down 10 to 15 per cent. A fair volume of business continues to be handled. Ironers of the same make are also easier.

ATLANTA

Jobbers report a steady but still decreased demand for lines of electrical material with a rather bright outlook for increased activity in the electrical building material lines, induced by increased home building and prospective industrial plant construction. Increased activity is to be noted in certain manufacturing lines, particularly in the construction of raw water ice plants, a number of those already in operation making additions, and an unusual number of serious inquiries being received for new plants and change-over of old ones from steam drive to electric. Reports from south and middle Georgia indicate that very much improved conditions are immediately ahead, because the peach and melon crops now being marketed are the best on record and are bringing excellent prices. As a result money is much easier and jobbing firms are expecting payment of long-outstanding accounts as well as a general resumption of activities in this section. The attitude of the national government regarding farm loans, particularly the announcement that Federal Reserve Banks would discount paper secured by cotton, is having a more encouraging effect on the rural districts. Still further indication of improved conditions is reflected in the government report of employment, the increase in Atlanta being 16.7 per cent over that of May. This condition exists to a smaller extent in other industrial centers in this section, though labor is in excess of the demand in the agricultural districts, particularly in Arkansas, Louisiana, Oklahoma and Texas.

Rigid Conduit.—With prices down 10 to 15 per cent there appears to be more activity in the demand, mostly from textile mills having uncompleted work and new jobs just starting. The demand in this section for black is weak as all the large contractors are endeavoring to standardize on galvanized.

Pole Line Hardware.—A price weakening has shown in this material for the past two months and has been subject to several reductions and the market has not stabilized so far. The demand is very poor and no improvement is expected until small central stations begin to build their primary lines to outlying residential districts, which are now beginning to grow rapidly, because of the boom in residential construction now under way.

Schedule Material.—Residential construction in the Southeast at this time calls for knob and tube work and allied material and therefore the demand for this material is fairly good.

Sewing Machines.—Dealers were overstocked and reduced the price, which stimulated sales. This is evidenced by a decrease of inventories and certain reorders from factory.

Two-Way Plugs.—The demand has been very good, due to national advertising campaigns and concentrated efforts on the part of dealers to merchandise this line. A price reduction of from 10 to 15 per cent is to be noted.

Lighting Fixtures.—The demand for the less expensive residential type has been excellent of late and all dealers are looking forward to a continued demand as the building season advances, and as the money situation eases up it is expected that builders will gradually go in for higher priced material.

ST. LOUIS

Conservatism to a high degree marks business activity in this territory. Very little change in the situation could be noted last week. Some improvement in buying is observed in the South due to the ability of the farmers to move cotton and other products to better advantage, but in the immediate vicinity of St. Louis business is very quiet. A large producer of automobiles has reduced production from a 40 per cent to a 20 per cent basis and operations on the higher basis had prevailed for but two or three months. While the purchasing of electrical goods by the industrials is extremely quiet slight improvement in the movement of appliances can be noted, particularly in fans and washing machines, the extremely warm weather causing the former and lowered retail prices the latter.

Electrical workers in St. Louis and East St. Louis went on a strike July 14 to retain the $1.25 per hour wage, which is that being paid the majority of the building trades. Efforts are being made, however, to get all the trades to enter into an agreement with the Building Industries Association whereby the same wage will be paid to all and all contracts will be for the same term, the wage being such as will encourage building. In the meantime very little construction work is being done and that is almost entirely for residential purposes.

Fans.—An exceptionally heavy demand for fans of all kinds developed last week, with the result that several dealers' stocks of the popular sizes were exhausted and at least one jobber's stock. The 10-in. and 12-in. oscillator has the

heaviest call. Indications are that a good fan business will continue for the next four weeks at least.

Washing Machines.—The local distributer of one well-known machine has temporarily reduced the list price from $160 to $109. Special campaigns are being conducted and as a result the movement of this machine has been materially improved. The reason for the reduction, it is reported, is to liquidate stocks.

Conduit.—With a reduction of 9 points in the discount of all kinds and sizes there is a fairly satisfactory demand for ½-in. black, but the larger sizes have but little call because of lack of industrial work. Some jobbers' stocks are about in line, others are slightly heavy, particularly in the larger sizes.

Ranges.—There is hardly any movement and interest is practically nil. It seems to be considered that this is not an opportune time to engage in campaign tactics.

Flat Irons.—Slightly improved retail demand is reported as a result of the recent price reductions. A few of the jobbers report substantially improved business.

Lighting Fixtures.—A large manufacturer and distributer of semi-indirect fixtures reports that the demand is about 50 per cent of normal and prevails particularly with clubs, churches, schools, etc. The plant is operating with about 75 per cent of its regular force. Prices are being fairly firmly maintained.

Domestic Refrigerators.—One distributer reports considerable interest in machines for residence purposes in St. Louis and immediate territory. Sales this year have been larger than last and the field is comparatively undeveloped. However, the general shortage of money has held up a number of sales. The price has recently been reduced from $595 to $395, installed in St. Louis. Delivery can be made from local stock.

SAN FRANCISCO

The building trades strike situation in San Francisco and Bay City has been much clarified during the past week by the action of the Oakland unions which voted in favor of resuming work at the new rate of $9.25 per day for electricians and of working on open shop jobs. Until San Francisco unions take similar action nearly all big building jobs in San Francisco will be tied up. So far an inadequate number of skilled workers have been sent here for the many jobs awaiting them, particularly in the case of the electricians. The value of building permits issued in the principal California cities during the month of June, 1921, is as follows: San Francisco, $950,965; Los Angeles, $6,269,546; Oakland, $1,486,412; San Diego, $799,944. The value of building permits issued during the corresponding month for 1920 was as follows: San Francisco, $1,949,692; Los Angeles, $6,610,681; Oakland, $1,050,642; San Diego, $204,935.

Flashlights.—For several months sales of flashlight materials have been excellent, due not only to seasonable sales to camping parties but also to clever window displays and increased sales efforts. Of course the principal sales are of battery renewals, but the introduction of new flashlights has considerably boosted the dealers' sales of cases.

Bells and Buzzers.—The new price on 3-in. iron box bells, class C, is 50 cents each in 100 lots, a large decrease from the former price. There is a 12 per cent higher price in package lots of ten, in which quantity most of the sales are being made.

Radiators.—The new prices on Majestic radiators for the 1921-22 season provide for the same discounts, grading from 30 per cent in single lots to 30-10 per cent in fifty lots, but the list prices are decreased a dollar or so, the new list on the best selling size being $12.50 each instead of $13.50. Dealers in general are inclined to postpone the placing of their orders for several months.

Ironers.—The demand for ironers has reached a sudden halt and efforts to improve it have resulted in a demoralized market. On some makes the lists are fairly steady, but on some of the older ironers sharp decreases have occurred in the retail price, with considerable variation from town to town.

SALT LAKE CITY—DENVER

The recent price reduction in electrical merchandise announced by manufacturers has created a flurry of demand among consumers, particularly for appliances. As a result retailers, generally unprepared, have made a run on jobbers that has strained their stock resources to the limit. To meet the exigency there is considerable interchange of stocks in lines that are plentiful. The sudden demand has clearly demonstrated that here price is the outstanding consideration with the buying public. Quality and service appeals are comparatively unimportant at the present time. Jobbers and dealers are hopeful that the improvement in the market is a foreshadowing of a return to normal conditions. There is already a better tendency to stock among jobbers and dealers alike.

The easing of the money market noted in the East has not yet become a tendency in the West and bankers are still ultra-conservative in granting loans. The lack of credit is pinching farmers particularly; in one or two cases states are coming to the rescue, co-operating with private financial concerns in granting urgent loans. The system, it is believed, will provide the necessary relief. The old tendency to hold crops for better prices is no longer manifest. The present yield forecast is highly encouraging in the Intermountain west. A revival of the mining industry, especially in copper, is looked for within the next twelve months. Building operations are proceeding at a fair rate, notwithstanding generally unsettled conditions.

Cooking Appliances.—There has been a noticeable pick-up in the demand in the last two weeks. The hot wave is partly responsible for this, but reduced prices are considered the main cause.

Bake Ovens.—The demand is steady, though the volume is not large. The market is limited to bakeries, hotels, hospitals, etc., and several orders for extra large sizes have been filled lately.

SEATTLE—PORTLAND

In Seattle and Puget Sound cities a generally quiet condition in trade and industry prevails, with retail business more active than wholesale and jobbing lines. With mills and logging camps operating with full crews and with prospective early railroad buying forecasted, the passing of the most prolonged period of extreme depression ever known to the west coast lumber industry bids fair to be accomplished. Manufacturers in Puget Sound and Portland districts report business still quiet. There are spasmodic reports indicating improvement and others of a more depressing nature, but the net result seems to be practically the same volume as for the past two months. Credits and collections in both districts show but little change and stocks, particularly in Seattle, are in excellent shape, with replacements easy to obtain. Jobbers in Seattle as well as Portland report business a trifle improved since the Fourth.

There appears to be a greater demand for standard package material and a tendency to demand carton packed goods. Portland dealers report the recent drop in prices on practically all schedule material, ranges and heating devices has aided in stimulating business somewhat, the greatest activity being noted in the sales of washing machines, stocks of which are in fine shape. This decrease in prices has not noticeably affected sales in the Puget Sound district. There is a considerable amount of contract work being taken on at the present time, but practically all of it is on a very narrow margin.

Grain crop reports emanating from the inland empire district and eastern Oregon are excellent and farmers have already contracted for a large portion of their crops. Generally speaking, throughout the district there is a surplus of common labor and cuts in wages are prevalent.

Electric Fixtures.—So far this year the fixture business in Seattle compares favorably with that of last year, especially as regards the moderate-priced residential type. Commercial fixtures have not moved particularly well.

Vacuum Cleaners.—Some improvement is noted, attributed largely to the warm weather and to the continual effort at publicity on the part of dealers with the easy terms of payment offered.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Refractories Association Makes Public Production Charts

In following Secretary Hoover's suggestion that trade associations should give to the public any production statistics they have heretofore compiled exclusively for their own membership circulation, one of the first associations to adopt this suggestion is the Refractories Manufacturers' Association, F. W. Donahoe, 840 Oliver Building, Pittsburgh, secretary, which has made up charts taking in figures for the entire refractories industry.

These charts show production, shipments, stock on hand and unfilled orders of certain refractories from January, 1919, to June, 1921, and indicate very clearly the condition of the steel industry in the last two and one-half years, an industry which accounts for more than 90 per cent of the fire clay and silica brick production every year.

New Catalog of R. Thomas Facilitates Export Business

The R. Thomas & Sons Company, East Liverpool, Ohio, manufacturer of porcelain insulators, etc., has just issued a new catalog entitled "Standard Electrical Porcelain," which includes several interesting features. For the convenience of foreign customers the dimensions of the various products are given in both inches and millimeters, a code word is listed for each item and the export as well as the domestic shipping weight is stated. Although these details are already a part of the company's catalog on high-tension insulators it is the first time that they have appeared in the publication devoted to standard porcelain.

Holabird to Distribute Weber Devices on Pacific Coast

Arrangements have been made by the Weber Electric Company, Schenectady, N. Y., with the Holabird Electrical Company to act as its sales representative on the Pacific Coast. H. A. Sayles, secretary of the Holabird Electrical Company, under the general direction of R. D. Holabird, will have charge of the Weber products. The offices of the Holabird company are in the Hobart Building, 582 Market Street, San Francisco, and 451 East Third Street, Los Angeles. A complete stock of Weber wiring devices will be carried in the Holabird warehouse in San Francisco, and a carload is now in transit from the factory at Schenectady. A comprehensive illustrated catalog of the complete line of Weber products is now on the press and will be ready for distribution during September.

Enlarged Production for Maker of Condensers

John E. Fast, Oak Park, Ill., manufacturer of electric condensers, has announced that the capacity of his plant has recently been enlarged and that he will be able to supply condensers on order in the future. At present the plant is turning out small telephone, violet ray machine and automobile ignition condensers. Mr. Fast was formerly with the American Telephone & Telegraph Company in Chicago.

Kuhlman Electric Company to Enlarge Plant

Plans are under consideration by the Kuhlman Electric Company, Bay City, Mich., manufacturers of transformers, for extensions to its plant. Under normal conditions the company is crowded for room and it is now planning to erect an addition providing about 5,000 additional square feet of manufacturing floor space.

Anchor Lite Appliance Company Moves to Larger Quarters

The Anchor Lite Appliance Company, Pittsburgh, Pa., manufacturer and distributer of electrical supplies and lighting fixtures, announces that it is now established in its new quarters at 420 Wood Street, where it occupies a four-story and basement building, approximately 10,000 sq.ft. of floor space. The company is doing everything possible to give twelve-hour service and thinks that as soon as it gets things in order it will be possible to get out all orders in one day's time. The company began business on a small scale in a two-story building at 25 Strawberry Way, less than a year ago. It makes a specialty of wholesale distribution to contractors and dealers and does not cater to the retail end of the electrical business, and in the little retail business that is done advises that the full retail price is maintained. The officers are: A. S. Goldstein, president; S. J. Goldberg, treasurer, and M. Kimball, secretary.

French Electrical Manufacturer Discontinues New York Office

The Compagnie Générale d'Electricité, Paris, France, which has maintained a purchasing office at 50 Church Street, New York City, for the past four years, has decided to discontinue this office on account of present business conditions. H. S. Foley, who has been the company's representative at that address since the office was first opened, will continue to occupy the same premises and will conduct a general electrical export business.

Aluminum Conductor Business Picking Up Well

Aluminum Company of America Has 71,000 Miles of Conductor in Use, 78 per Cent in United States

The aluminum conductor business of the Aluminum Company of America, Pittsburgh, has been picking up better and better each month of this year so that it is expected new stranding machines will have to be added. One feature of the orders seems to be the rather quick shipments asked. Export business is good, a recent order of note being for 2,000,000 lb. of aluminum conductor for the Morwell Brown-Coal Power Scheme in Australia. The Melbourne coal fields are about 100 miles from Melbourne City.

Seven hundred miles of standard 336,400-circ.mil aluminum cable steel reinforced, which was sold to the government of the Victoria Electricity Commissioners, will be used on a double circuit three-phase high-tension line operating at 132,000 volts, 50 cycles. The cable will be suspended from suspension insulators attached to steel towers placed 1,056 ft. apart.

Up to June of this year there were about 71,000 miles of aluminum conductor in service which has been manufactured by the Aluminum Company of America and its affiliated interest, the Northern Aluminum Company, Ltd., Toronto, Canada. Of this quantity of aluminum conductor, approximately 50 per cent is composed of aluminum cable, steel reinforced. Of this total amount 78 per cent is in service in the United States, 15 per cent in Canada, 2.3 per cent in Europe, 2.2 per cent in South America and 2.5 per cent in other parts of the world.

Piedmont Electric Establishes Branch in Greensboro

The Piedmont Electric Company, which has been in business for nineteen years, maintaining headquarters in Asheville, N. C., is establishing a branch in Greensboro, N. C., which will soon be ready for business. Up to this time the company has been covering out of Asheville all of North and South Carolina with the exception of that portion directly on the coast. Increase of business in eastern North Carolina has

made necessary a warehouse and branch office in Greensboro. The branch office in Greensboro will be at 335 South Davis Street and will be in charge of Frank B. Bibb as local manager. B. C. Banks, who has for several years been with the company in charge of the eastern territory, will continue in this capacity but will work directly in connection with the Greensboro warehouse. This branch, with the advantage of the reduction in freight rates to Carolina points which has just been established, will enable the company to distribute to territory contingent to Greensboro at a saving to the consumer on transportation.

New Manufacturers' Agency Established at Columbus

S. E. Ringgold, formerly general sales manager of the Moock Electric Supply Company, Canton, Ohio, has established an office in the Ferris Building, Room 502, Columbus, Ohio, and is now covering all of Ohio, western Pennsylvania, and all of western Virginia, representing the following manufacturers: The Fernando C. Mesa Company, Irvington, N. J.; the Federal Porcelain Company, Carey, Ohio; the William Wurdack Company, St. Louis (switchboxes); the Saylor Electric & Manufacturing Company, Wheeling, W. Va., and the Magic Electric Company, New York City. He contemplates taking on two or three more lines, probably rubber-covered wire, conduit, and flexible-armored conductor.

Industrial Cost Association Conference Successful

With the overshadowing interest of cost problems in the manufacturing world of today, the conference of the Industrial Cost Association at East Aurora, N. Y., the last of May, carried particular significance. The association was incorporated only last January by plant executives who desire to standardize manufacturing cost methods, and the progress made toward the solution of many important cost problems at the conference was considered by those attending to be very satisfactory.

The greatest interest was manifested in the topic "Should Abnormal Burden Be Included in Current Monthly Cost?" More than fifty speakers gave their views on this subject and a vote showed a sentiment of three to two in the negative. "Current Influences on Cost Problems," "Current Problems in Expense Distribution," "Uniform Cost Systems," "Human Element in Costs" and "Standardization of Cost Terminology" were discussed. Addison Boren, Yale & Towne Manufacturing Company, was named chairman of a committee to write a lexicon of cost terminology.

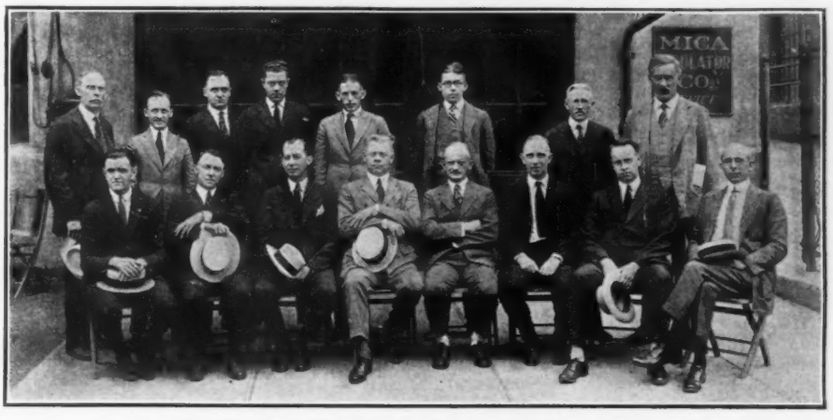
As an outcome, the conference agreed that complete uniform cost systems, adaptable to all factories alike, cannot be devised, and also that the best cost system is one which is developed from the factory end by employees. Boston, Bridgeport, Philadelphia, Rochester, Buffalo, South Bend, Cleveland, Cincinnati, Milwaukee and St. Louis have asked for local sections.

On the resignation of M. F. Simmons, General Electric Company, as president of the Industrial Cost Association, J. W. Stannard, American Autoparts Company, was elected president. Mr. Simmons remains a national director. A. A. Alles, Jr., People's Bank Building, Pittsburgh, is secretary-treasurer.

Mica Insulator Meets in Annual Convention

The annual sales convention of the Mica Insulator Company, with representatives from New York, Cleveland, Cincinnati and Chicago, was held at the company works, Schenectady, N. Y., lasting the entire week of June 20. Among those present who have been connected with mica insulation since early days were E. C. Wood, vice-president of the company, and C. W. Jefferson, one of the pioneers in the commercial use of mica insulation material in the electrical industry. The great progress which has been made by the mica insulation industry during the past thirty years was well illustrated in the company's eighteen-building plant. Of particular interest was a flexible, oiled cotton tube, a recent development to withstand high temperature.

The convention was marked with great enthusiasm throughout and the consensus of opinion was that the future outlook for the mica insulation industry was very bright.



MICA INSULATOR MEN LOOK FOR BRIGHT FUTURE

New Building Started in New York for Dodge Manufacturing Company

The Dodge Manufacturing Company, Mishawaka, Ind., the sales organization of which is the Dodge Sales & Engineering Company, has virtually completed excavation for its new $1,000,000 building in New York City. This will occupy 165 ft. on West Broadway, 50 ft. on Murray Street and 75 ft. on Park Place. It is laid out for twelve stories at this time but foundations and construction will be sufficient to take care of an additional four stories. Further building plans are being completed as rapidly as possible. The basement and part of the first three floors will be used by the Dodge Sales & Engineering Company for warehouse and for "Dodge service," both domestic and export, while the remainder of the building will be leased. Occupancy is expected by May 1, 1922.

The company finds an increasing number of inquiries for machinery and engineering service, and at the same time it is closing more of these inquiries than it has been doing in the past few months. This is particularly true in the New York and New England territories and in Canada.

Receiver Appointed for National Conduit and Cable

Judge Knox in the United States District Court on July 15 appointed Clarence G. Galston receiver in equity of the National Conduit & Cable Company, Hastings-on-Hudson, N. Y. Suit was brought by a large holder of stocks and bonds of the company after several months of endeavor to straighten out the company's affairs.

Since the early months of this year a committee of the stockholders, a committee of the bondholders and a committee of the company have tried to work out a financing plan but the support of a majority of the stockholders could not be received and the receivership became necessary.

J. R. Crawford, general sales manager of the Union Carbide Sales Company, New York City, has been appointed general sales manager of the National Carbon Company, Inc., Cleveland, succeeding N. C. Catabish, who takes up other duties with the company.

American Di-Electrics, Ltd., announces change in address of E. A. Thornwell, its Atlanta, Ga., distributer to Candler Building.

The Clary-Cummings Battery Company, Columbus, S. C., manufacturer of storage batteries, contemplates increasing its capital stock from $10,000 to $20,000. The company would like to receive catalogs from manufacturers of battery boxes, plates, lead parts, separators, rubber jars and lead-coated bronze terminals, etc.

Foreign Trade Notes

FRENCH POWER PLANT BUDGET EXPENDITURES.—In the French budget of 1921, recently published in the *Journal Officiel*, the amount of 7,473,450 francs is apportioned for power plants.

HYDRO-ELECTRIC DEVELOPMENT IN SWITZERLAND.—According to a report of a special survey by the Swiss Bureau of Hydrography recently published the total available water power of the country is estimated at 2,173,238 hp., or an average of about 52.62 hp. for each square kilometer of Swiss territory. The report further shows that about 25 per cent of the available water power of the country is already being utilized, there being installations of 6,860 plants, having 3,170 turbines and 4,903 wheels, developing 526,098 hp. Of the 526,000 hp. already developed more than 50 per cent (312,000 hp.) is utilized by electric power plants, followed by the chemical industry, utilizing 112,000 hp. The federal state, the several cantons and various communes control about 400 plants.

ITALIAN CONCERN TAKEN OVER BY THE GENERAL ELECTRIC COMPANY.—According to *Il Messagero* the electrical manufacturing firm of Società Electrotecnica Galileo Ferraris of Milan, Italy, has been taken over by an American for the General Electric Company. Before the war the Galileo Ferraris concern was known as the Thomson-Houston Company.

GERMAN ENGINEERS TO DISCONTINUE USE OF SUBSTITUTE METALS.—According to the *Electrical Review*, London, the Union of German Electrical Engineers (V.D.E.) has decided to discontinue as from Oct. 1 the use of substitute metals (iron, zinc, etc.) because they are unprofitable. The government, however, is considering a scheme for maintaining such substitutes, particularly aluminum.

GERMAN INTEREST IN SPANISH ELECTRICAL COMPANY.—At a recent meeting of the Compania Hispano-Americana de Electricidad, Madrid, Spain, says the *Electrical Review*, London, they have elected to the board of directors four Germans who are prominent in banking and electrical manufacturing companies. This action is interesting in view of the fact that last summer the South American operation of the German Transmarine Electricity Company, Berlin, was transferred to the Compania Hispano-Americana de Electricidad. It would seem from this that a continuation of German influence in central station and traction operations in South America was being effected.

A. E. G. ENDEAVORING TO RECOVER GERMAN EXPORT MARKET.—Before the war the A. E. G. exported 40 per cent of its total production and it is the company's determination to recover, if possible, this lost export business. It has been proposed to re-establish the export organization; a lot of this has been maintained in America and the East, but everything has been destroyed in the allied countries. Having regard to the situation of gold currency, Dr. Rathenau observed that it certainly sounded absurd to build up the export organization in mark currency. This absurdity, however, did not actually exist as the question substantially concerned the possibility of supplying goods made in Germany to other countries on credit. As to the siutation of business, Dr. Ratheneau said the company's orders on hand were satisfactory in number but were not so uniform as in former years. Large machines were in great demand at present and the orders for them would insure work for a long time to come.

GOOD REPORTS OF BRITISH ELECTRICAL MANUFACTURERS.—The reports of several electrical manufacturing companies for 1920, recently issued, according to the *Electrician*, have shown very good results considering the adverse conditions prevailing. In all cases there is an increase in the gross and net profits, the dividends are either maintained at the old rate or increased. The Brush Electrical Engineering Company in its report shows a net profit of £191,096, against £148,685, and is again paying 15 per cent on an increased capital, besides devoting the usual sum to pay off the 6 per cent second prior lien debentures, adding £53,377 to the general reserve and increasing the balance forward from £85,568 to £143,268. The Metropolitan-Vickers Electrical Company reports an increase of £81,555 in the gross profit and of £83,231 in the net profit. After devoting £100,000 to reserve, £35,000 to special depreciation and increasing the carry-over, the directors are able to raise the dividend on the ordinary shares from 8 to 12½ per cent. The orders received during 1920 were in value about 80 per cent greater than those in 1919, while the orders completed were in value about 50 per cent greater. Johnson & Phillips also announce an increase in profits from £90,000 to £98,400, and the ordinary dividend is maintained at 12½ per cent, but on a larger capital.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A merchant in Italy (No. 35,179) desires to secure an agency for the sale of electrical appliances, etc., for industrial purposes.

A commission merchant from Japan (No. 35,189) who is in the United States, desires to purchase an ice plant ammonia compressor, ice plant motor, vacuum cleaners, railway supplies and equipment, etc.

POSSIBLE DEMAND FOR ELECTRIC SUPPLIES IN PALESTINE.—In a recent report on trade matters in Damascus, Palestine, it is stated that among electric goods most likely to find a sale in Damascus would be electric light fittings and shades.

ELECTRIC LIGHTING SYSTEM FOR MOULMEIN, BOMBAY. — Proposals are asked by the Municipal Committee of Moulmein for the installation of an electric lighting system in the town.

TENDERS ASKED FOR PORCELAIN INSULATORS.—Tenders will be received by the New Zealand Public Works Department, Government Buildings, Wellington, New Zealand, until Aug. 9 for suspension type porcelain insulators to carry 110,000-volt 50-cycle transmission lines in connection with the Waikato electric power scheme. Specifications may be seen at the Department of Overseas Trade, 35 Old Queen Street (Room 59) Westminster, S. W., 1, London.

ELECTRIC PLANT FOR BULAWAYO, RHODESIA, SOUTH AFRICA. — Tenders are invited by the municipality of Bulawayo, Rhodesia, South Africa, for material and equipment for an electric light and power plant, including two sets of gas producing plants, gas engines, three-phase generators (300 kw.); alternative steam plant, main switchboard, switchgear, distribution houses and transformer houses, insulators, hard-drawn bare copper wire, three-core cable, insulated cable, etc. Specifications and form of tender may be obtained on payment of deposit of £3 3s., from Davis & Soper, Ltd., 54 St. Mary Ave., London, E. C., 3, who will receive tenders until Aug. 3.

New Apparatus and Publications

ELECTRIC WATER HEATING. — The Electric Boiler Corporation, 475 Main Street, Cambridge 39, Mass., manufacturer of the "Electric Boilerette," has issued data sheet No. 6, containing information on electric water heating.

EXPANSION JOINT. — The Griscom-Russell Company, 90 West Street, New York City, has recently placed on the market its low-pressure expansion joint known as the G-R type "C."

RADIO RECEIVER. — "Aeriola Jr." is the title of a leaflet issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describing its new radio receiver unit.

EXCAVATOR CRANE.—Bulletin 6-X describes the Pawling & Harnischfeger Company, Milwaukee, newly developed No. 206 excavator-crane which can be used in coal and ash handling and with a lifting magnet.

STORAGE BATTERY TESTER.—The "Startometer" has been developed by the Shire Electrical Products Company, Marquette Building, Detroit, for measuring storage-battery output under load. A folder is issued on this instrument.

BELT CONVEYORS. — The Link-Belt Company, 910 South Michigan Avenue, Chicago, has issued a new book, No. 215, on belt conveyors in which it describes the "Uniroll" and "Multiroll" idlers. The company has also issued a new steel chain data book, No. 475.

REFRIGERATION.—The Automatic Refrigeration Company, Hartford Conn., has issued a booklet entitled "Automatic Refrigeration" in which it describes its different methods of automatic refrigeration.

WATER-COOLING APPARATUS.—The Binks Spray Equipment Company, 3114 Carroll Avenue, Chicago is distributing a small circular describing its "Spra-Rite" cooling pond equipment for steam and ammonia condensers.

BALANCE COILS AND AUTO TRANSFORMERS.—The Sorgel Electric Company, 138 West Street, Milwaukee, is distributing a bulletin describing its air-cooled balancing coils and auto transformers.

ELECTRIC LIFT TRUCK.—Bulletin No. 5, issued by the Cowan Truck Company, Holyoke, Mass., describes the "Cowan" electric self-loading truck which it has recently placed on the market.

ASH HANDLING EQUIPMENT.—Conveyors Corporation of America, 326 West Madison Street Chicago, has issued a booklet "Proof of the Pudding" containing letters from users of its ash handling equipment.

HOUSEHOLD UTILITY MOTOR.—Reynolds Electric Company, 2650 West Congress Street, Chicago, has developed an improved "Reco" household utility motor for kitchen work. A circular has been issued on this.

BATTERY IGNITION. — The American Bosch Magneto Corporation, Springfield, Mass., has developed a new compensating battery ignition system described in its July *Bosch News*.

DRILL STAND.—The Independent Pneumatic Tool Company, Chicago, has put on the market the "Thor" electric drill stand for converting portable electric drills to drill presses.

New Incorporations

THE CLARION DISTRICT HYDRO-ELECTRIC COMPANY, Wilmington, Del., has been chartered under the laws of the State of Delaware with a capital of $2,000,000 to generate and distribute electricity. The incorporators are M. M. Lucey, V. P. Lacey and L. S. Dorsey.

THE LANE SIGNAL ACCESSORIES, Sayre, Pa., has been incorporated under the laws of the State of Delaware by William H. Lane, Harry S. Fish and Raymond L. Gebhardt, Sayre, Pa. The company is capitalized at $500,000, and proposes to manufacture electrical equipment and signal devices.

THE MARQUETTE ELECTRIC COMPANY, 222 West Austin Avenue, Chicago, Ill., has been incorporated by Harold B. Harvey, Harry I. Kirk and Samuel Hohman. The company is capitalized at $200,000, and proposes to manufacture electrical appliances, etc.

THE M. & M. ELECTRIC COMPANY, Louisville, Ky., has been incorporated with a capital of $15,000 by John McG. Miller, Joseph Muir and A. M. Marrett, all of Louisville.

THE GRAYWYN, INC., 220 North Holliday Street, Baltimore, Md., has been incorporated by Jack Albert, Lee Silver and Joseph Silverman. The company is capitalized at $10,000 to manufacture and deal in electrical equipment and appliances.

THE DISTRIBUTORS ELECTRIC COMPANY, Canistee, N. Y., has been incorporated by J. N. Anderson, H. and T. C. Cobb. The company is capitalized at $20,000, and proposes to manufacture electrical equipment.

THE CON-DEN-RIT RADIANT LOG COMPANY, Elizabeth, N. J., has been incorporated with a capital of $100,000 to manufacture electric heating and lighting equipment. The incorporators are James P. Conroy, Orange; Charles C. Denton and Albert F. Reithemeyer, Elizabeth.

THE W. E. GROFF COMPANY, Easton, Pa., has filed notice of organization to manufacture and deal in electrical products. The incorporators are W. E. Groff, John Stead and Harvey Herstein. The company is capitalized at $25,000.

THE AUBURN-WOODBURN ELECTRIC COMPANY, Auburn, Ky., has been organized with a capital of $30,000 by J. Guthrie Coke, R. L. Stevenson and R. W. Wilson. The company will purchase electricity from the Kentucky Public Service Company, Bowling Green.

THE CONTINENTAL ELECTRIC COMPANY, LTD., has been formed to manufacture and sell Royal electric cleaners in Canada. The new organization has its headquarters at 507-511 King Street East, Toronto, Ontario.

THE HYDRO APPLIANCES, LTD., recently incorporated with a capital stock of $200,000, has purchased the former plant of the Dominion Canners, Ltd., Port Robinson, Ontario, which it will equip for the manufacture of an electric washer and ironing machine and other electrical appliances.

THE AMERICAN GENERATOR COMPANY, Poseyville Ind., has been incorporated by E. D. Fletchall, O. E. Caudell and Valentine Bender, Poseyville. The company is capitalized at $100,000 and proposes to manufacture electric equipment for lighting, heating and cooking.

THE ABOTT ELECTRIC & SUPPLY COMPANY, Buffalo N. Y., has been incorporated with a capital of $10,000 to manufacture electrical appliances and to engage in electrical contracting. William F. Burket, 61 Englewood Avenue, is interested in the company.

THE ELECTRICAL SPECIALTY MANUFACTURING COMPANY, 51 Beaufort Street Providence, R. I., has been organized to manufacture electrical equipment. W. B. and L. J. Hopkins are interested in it.

THE IDEAL ELECTRIC DUMB-WAITER COMPANY, Buffalo, N. Y., has been incorporated with a capital of $50,000 to manufacture electrically-operated dumb-waiters and other lift equipment. The incorporators are G. A. Irwin, J. D. Hillery and J. A. Wechter. The company is represented by Sullivan, Bagley & Wechter, Chamber of Commerce Building.

THE ECONOMY ELECTRICAL MANUFACTURING COMPANY, New Haven, Conn., has been incorporated by A. I. Lapides, S. D. Pardoll and S. Jacobson, 1 Lawrence Street. The company is capitalized at $25,000 and proposes to manufacture electrical equipment.

Record of Electrical Patents

Notes on United States Patents

(Issued July 5, 1921)

1,383,750. ALTERNATING-CURRENT SIGNALING SYSTEM; Ralzemond D. Parker and Baxter P. Hamilton, Brooklyn, N. Y. App. filed June 26, 1918. Same circuit for several messages.

1,383,756. AUTOMATIC SWITCHING APPARATUS FOR TELEPHONE EXCHANGE SYSTEMS; John N. Reynolds, Greenwich, Conn. App. filed Aug. 1, 1917. Two electromagnets used in operation.

1,383,764. SOCKET FOR ELECTRIC-LIGHT GLOBES; John A. Sargent, Normanby, Taranaki, New Zealand. App. filed June 13, 1919. No spring contacts.

1,383,789. TELEPHONE EXCHANGE SYSTEM; Roy D. Conway, Chatham, N. J. App. filed Aug. 24, 1918. Manual connected to automatic exchange.

1,383,796. TROLLEY HARP EXTENSION; Walter F. Freeman, Springfield, Mass. App. filed March 5, 1921. Cushion support for wheel.

1,383,797. TROLLEY SHOE; Walter F. Freeman, Springfield, Mass. App. filed April 15, 1921. Scraper for removing snow.

1,383,799. ELECTRICAL REGULATING DEVICE; Edgar W. Gent, New York, N. Y. App. filed May 1, 1920. Rheostats, etc.

1,383,802. SIGNALING DEVICE; Charles L. Goodrum, New York, N. Y. App. filed May 14, 1917. Machine switching telephone.

1,383,804. TELEPHONE EXCHANGE SYSTEM; John A. Hall, Bayside, N. Y. App. filed Nov. 19, 1918. Substation apparatus.

1,383,805. PARTY-LINE METERING SYSTEM TELEPHONE EXCHANGES; John A. Hall, Bayside, N. Y. App. filed Nov. 19, 1919. For party lines.

1,383,807. POWER MODULATION FOR RADIO-TRANSMISSION; Raymond A. Heising, East Orange, N. J. App. filed Sept. 21, 1915. High-frequency.

1,383,845. STORAGE-BATTERY CONNECTOR; William H. Palmer, Jr., Wyncote, Pa. App. filed March 28, 1917. For automobiles.

1,383,879. OUTLET BOX; George C. Thomas, Jr., Elizabeth, N. J. App. filed Nov. 21, 1919. Wall of outlet utilized as seating surface.

1,383,949. ELECTRIC STOVE; John A. Howard, Sr., West New Brighton, N. Y. App. filed July 3, 1920. Percolator.

1,384,014. METHOD AND APPARATUS FOR SIGNALING AND OTHERWISE UTILIZING RADIANT IMPULSES; Reginald A. Fessenden, Brookline, Mass. App. filed Jan. 14, 1918. Submarine detector and signal.

1,384,017. ELECTRIC LANTERN; John Haack, Portland, Ore. App. filed May 10, 1920. Electric cell easily accessible.

1,384,028. FUSE PLUG; Ernest H. Baxter, Chicago, Ill. App. filed Aug. 5, 1916. Refillable.

(Issued July 12, 1921)

1,384,067. WEATHERPROOF ELECTRIC HEATER; Lee P. Hynes, Albany, N. Y. App. filed May 8, 1920. High heat without deterioration.

1,384,101. SERVICE-BRACKET FOR TELEPHONE-RECEIVERS; Sidney C. Sladden, New York, N. Y. App. filed July 31, 1919. Holds receiver to ear.

1,384,108. MEANS FOR GENERATING ELECTRICAL OSCILLATIONS; Roy A. Weagant, Roselle Park, N. J. App. filed April 9, 1914. By gaseous conducting medium.

1,384,143. X-RAY APPARATUS; William Meyer, Chicago, Ill. App. filed May 29, 1918. Improved transmission tower.

1,384,144. X-RAY APPARATUS; William Meyer, Chicago, Ill. App. filed May 31, 1918. Improved generator cabinet.

1,384,177. MAGNETIC PULLEY; John P. Bethke, Milwaukee, Wis. App. filed Aug. 23, 1918. Air cooled.

1,384,182. ROOM-CALLING SYSTEM FOR HOTELS; Oreste Conti, Viareggio, Italy. App. filed Jan. 20, 1920. Automatic call system.

1,384,214. INSULATOR; Richard Sands, Osawatomie, Kan. App. filed Sept. 18, 1919. No tie wires needed.

1,384,256. MOTOR; Annie L. Harrell, Seattle, Wash. App. filed June 7, 1920. For small appliances.

1,384,295. ELECTRIC REPRODUCER FOR PHONOGRAPHS; Henri Armagnat and Pierre Frely, Paris, France. App. filed May 19, 1919.

1,384,352. ELECTRIC WINDING DEVICE; Fritz Sauter, Basel, Switzerland. App. filed Dec. 13, 1919. For clockworks.

1,384,396. TELEGRAPH SYSTEM; Benjamin F. Merritt, East Orange, N. J. App. filed Oct. 10, 1917. Multiple distribution of messages.

1,384,398. SIGNALING SYSTEM; Louis A. Mortimer, New York, N. Y. App. filed July 12, 1917. Non-interfering.

1,384,418. TROLLEY; Christian Aalborg, Wilkinsburg, Pa. App. filed April 18, 1917. Contact pressure may be materially changed.

1,384,439. ELECTRODE HOLDER FOR ARC WELDING; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Nov. 24, 1919. For overhead welding.

1,384,458. ADJUSTABLE TROLLEY-WHEEL FORK; David M. Fowler, Terre Haute, Ind. App. filed Aug. 28, 1920. Will automatically hold wheel on wire.

1,384,464. DRIVING AND CONTROLLING MECHANISM FOR POWER-OPERATED MACHINES; Martin Hemler, Elizabeth, N. J. App. filed May 28, 1918. For sewing machines, etc.

1,384,467. BANDAGE; John G. Homan, Steubenville, Ohio. App. filed Jan. 27, 1920. Electrically heated.

1,384,479. TIME-CONTROLLED ADVERTISING DEVICE; Thomas J. Mosure, Niles, Ohio. App. filed Nov. 29, 1919. Projects pictures on screen in rotation.

1,384,491. CONNECTOR; Karl A. Simmon, Edgewood Park, Pa. App. filed June 13, 1917. Train-line connectors.

1,384,495. SYSTEM OF CONTROL; Norman W. Storer, Pittsburgh, Pa. App. filed Oct. 17, 1918. Electric railway motors.

1,384,499. METHOD OF AND APPARATUS FOR REFINING METALS; Samuel A. Tucker, New York, N. Y. App. filed May 7, 1920. Electrolytic.

1,384,504. CHANGE-SPEED GEAR; Gillis von Zweigbergk, St. Annes on Sea, England. App. filed July 23, 1918. Electric control.

1,384,523. WIRELESS SIGNALING APPARATUS; Athelstan A. Hall, London, England. App. filed Nov. 1, 1919. Without usual aerials.

1,384,579. AUTOMATIC TRANSMISSION-CONTROLLING MEANS; John T. Toomey, New York, N. Y. App. filed Oct. 16, 1917. Telephone repeater circuits.

1,384,587. MANUFACTURE OF COMPOSITION CORES; Harry T. Bellamy, Oak Park, Ill. App. filed Sept. 29, 1919. For electrical windings.

1,384,636. FLASHLIGHT; Arthur C. Sachse, Detroit, Mich. App. filed Sept. 2, 1920. No battery.

1,384,658. OCCULTING LIGHT; Henri L. M. J. Benard, Paris, France. App. filed April 3, 1919. Long-distance luminous signals.

1,384,660. ELECTRIC HEATING PLATE; Michael Gorritzen, Stavanger, Norway. App. filed Nov. 10, 1920. Separate plates which may be heated independently.

1,384,683. PROCESS FOR AMALGAMATING METALS; Ransom H. Stevens, Los Angeles, Cal. App. filed Aug. 29, 1918.

1,384,716. ELECTRIC THERAPEUTIC APPARATUS; Louis F. Bogia, Philadelphia, Pa. App. filed July 15, 1920. To generate ozone.

1,384,719. ELECTRIC WATER HEATER; Clarence C. Herbert, Lincoln, Neb. App. filed Aug. 8, 1919. To heat water in any vessel.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LYNN, MASS.—Steps have been taken in West Lynn to raise the sum of $6,000 to secure an ornamental lighting system from Market Square to McDonough Square. T. A. Garafano, City Councilor, is member of the committee in charge.

MILFORD, MASS. — The residents on Cedar Street have petitioned the Selectmen to have the electric light service extended to their part of the town. The Milford Electric Light & Power Company supplies electric service in Milford.

NEW BEDFORD, MASS. — The City Council has authorized changing the lighting system in Russell Street to be connected with the underground conduits which are being laid in Russell Street from Achushnet Avenue to County Street. This is part of the mile-a-year underground work that the New Bedford Gas & Edison Light Company is doing.

ANSONIA, CONN.—Bids have been received by the Ansonia O. & C. Company, it is reported, for the construction of a two-story addition to its plant, 75 ft. x 250 ft., to cost about $125,000. The plans provide for a power house.

Middle Atlantic States

ALBANY, N. Y. — Bids have been received for the installation of eight electrically operated pumps in the city filtration plant.

BUFFALO, N. Y.—A hearing will be held by the State Water Power Commission in Albany, July 27, regarding the joint applications of the lower Niagara River Power & Development Company, the Niagara Gorge Power Company and the Niagara Gorge Railroad Company for development rights in the lower Niagara River. The Federal Power Commission has already approved the plan to divert water for power development in the lower river between the cantilever bridge and Devil's Hole.

GREENPORT N. Y.—At a special election held recently, the proposal to issue

$34,500 in bonds for improvements to the electric light plant was defeated for the second time.

MIDDLETOWN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Aug. 3, for construction, heating, sanitary and electric work, additional accommodations for chronic patients (east group), etc., at the Middletown State Homeopathic Hospital, Middletown. Drawings, specifications and blank forms of proposals may be consulted at the Middletown Hospital, at the New York office of the Department of Architecture, Room 618, Hall of Records Building and at the department of Architecture, Capitol, Albany.

NORTH GREECE, N. Y.—Work has been started on the extension of the power lines of the Rochester Gas & Electric Corporation through North Greece, a distance of 6 miles.

PHELPS, N. Y.—Extensions of the electric and gas service to residents of Clifton and Mary Streets is under consideration. The Empire Gas & Electric Company supplies electric service in Phelps.

VENICE, N. Y.—The Poplar Ridge Lighting Company has applied to the Public Service Commission for permission to construct an electric light plant in the town of Venice.

WYNANTSKILL, N. Y. — The Town Board of North Greenbush has entered into contract with the Wynantskill Hydro-Electric Company for the installation of an electric street-lighting system in Wynantskill. The plans provide for lamps along the main street from the Albia Station to the Pawling Sanatorium, and also on the streets in the "hill section" of the village.

GLOUCESTER, N. J.—Bids will be received by the Council of Gloucester, N. J., until Aug. 4, for improvements to the municipal water supply system. The project includes the following items: Contract 1—Construction of a 30 ft. dia. x 125 ft. high steel standpipe. Contract 2—Pumping station, exclusive of equipment, and concrete settling basin, Section "A"; standpipe foundation, Section "B." Contract 3—Mechanical and electrical equipment, consisting of six motor-driven centrifugal pumps, switchboard, electric wiring and auxiliaries, Section "A"; furnishing and erecting all inside and outside station piping, Section "B"; Venturi meter, Section "C." Contract 4—one 150-kw. oil engine driven generating set. Contract 5—Two or more artesian wells. Plans and specifications are on file and may be seen at City Hall, Gloucester and at the office of Remington & Vosbury, engineers, 601 Market Street, Camden, N. J.

PHILADELPHIA, PA.—The Logan Baking Company contemplates the construction of a new three-story and basement plant, 50 ft. x 125 ft. The plans include a one-story power plant. T. Frank Miller, 1012 Walnut Street, is architect.

YORK, PA.—Eleven electric companies including the Glen Rock Light, Heat & Power Company, Hopewell Township Light, Heat & Power Company, New Salem Light & Power Company, North Codorus Light & Power Company, Seven Valleys Light & Power Company, Codorus Township Light & Power Company, Shrewsbury Light & Power Company Springfield Township Light & Power Company, Loganville Light & Power Company and the Jefferson Light & Power Company have applied to the Public Service Commission for permission to consolidate under the name of the Glen Rock Light, Heat & Power Company.

DOVER, DEL.—Bonds to the amount of $30,000 have been sold, the proceeds to be used for improvements to the municipal electric light and water plant.

CAMBRIDGE, MD. — The plant of the Cambridge Ice Company and the power plant and pumping house of the Dorchester Water Company, it is reported, were recently destroyed by fire. The loss is estimated at about $70,000.

SOUTH HILL, VA.—The town has authorized the issue of $150,000 in electric light, water and sewer bonds.

North Central States

DETROIT, MICH. — Contract has been awarded to the Hazleton-Clark Company for the construction of a brick and steel power house to be built at Clark and Wabash Avenues for the Timken-Detroit Axle Company.

ECORSE, MICH. — The Hinkley Motors Corporation, 3240 West Fort Boulevard, Detroit, is having plans prepared for the construction of a one-story factory and office building 250 ft. x 340 ft., and a one-story power house, 52 ft. x 60 ft. on Cicotte Avenue, Ecorse. A. Kahn, 1000 Marquette Building, Detroit is architect.

CLEVELAND, OHIO.—Bids, it is understood, are being received by H. C. Bishop & Company, architects, Guardian Building for the construction of a one-story power plant, 40 ft. x 75 ft. on Cedar Avenue, for Telling-Belle-Vernon Company. The cost is estimated at $50,000.

CLEVELAND, OHIO.—The City Council has authorized the Cleveland Railway Company to construct and operate a single-track street railroad on St. Clair Avenue from Nottingham Road, the present terminus of the St. Clair Avenue line, to the present city limits west of East 200th Street.

MARIETTA, OHIO.—An election will be held in August to submit to the voters a proposal to issue $500,000 in bonds for the construction of a hydro-electric plant in Lowell. H. Gamper, New First National Building, Columbus, is engineer.

NEW PHILADELPHIA, OHIO. — The City Council has instructed City Engineer Arnold to prepare plans and estimates for the installation of three electrically operated pumps with a daily capacity of 750,000 gal. at the muncipal waterworks pumping station to replace steam pumps now in use.

MUNCIE, IND. — The City Council has directed the Electric Light Committee to make investigations regarding the extension of the ornamental lighting system southward on Walnut Street as far as Twelfth Street.

CHICAGO, ILL.—Plans have been prepared by C. H. Shepard, consulting engineer, for the installation of a lighting system in the Woodlawn district to cost about $50,000. O. S. Turner, care of McKey & Poague, is chairman of the street-lighting committee, Woodlawn Business Men's Association.

FREEBURG, ILL.—The lowest bid submitted for rebuilding the municipal electric light plant was $37,000. As only $25,000 has been voted for the work the plans will have to be changed or additional bonds voted.

STERLING, ILL.—The City Council has authorized the installation of seventy-nine additional lamps in the business district of the city.

KIMBALLTON, IOWA. — The electric light plant has been sold to the town of Kimballton for $12,000, contingent upon the approval of the voters to issue $20,000 to purchase and improve the plant.

MILWAUKEE, WIS.—Preliminary plans are being prepared by E. Brielmaier & Sons engineer, 432 Broadway, for the construction of a power plant at Marquette University, 1115 Grand Avenue.

BRASHEAR, MO.—The city officials are considering the erection of a transmission line.

SIKESTON, MO. — The Missouri Public Utilities Company is considering rebuilding its local power plant recently destroyed by fire.

SPRINGFIELD, MO. — The Springfield Gas & Electric Company will install twenty-five additional incandescent street-lamps in the city.

JAMESTOWN, N. D.—The State Railroad Commissioners are considering the erection of a high-tension transmission line to supply electricity to towns near Jamestown on the main line and branches of the Northern Pacific Railroad and also on the Soo and the Great Northern and Midland Continental, and also to farmers in the vicinity.

ORLEANS, NEB.—The city of Orleans has authorized an issue of $50,000 in electric light bonds.

Southern States

DUNN CENTER, N. C.—The plant of the Farmers Elevator & Light Company was recently destroyed by fire. The town at present is without street-lighting service.

DURHAM, N. C. — Extensions to the lighting system on Chapel Hill and Mangum Streets are under consideration. Electrical energy is supplied by the Durham Traction Company.

ELK CITY, N. C.—The City has issued electric light bonds to the amount of $25,000.

COLUMBUS, GA.—The city officials are considering the installation of a lighting system on Triangle Street.

LEXINGTON, GA.—Work is under way on the installation of an electric lighting system in Lexington.

LAKE BUTLER, FLA.—The Council is considering the issue of $10,000 in electric light bonds.

BRISTOL, TENN.—The power plant of the Bristol Gas & Electric Company was recently damaged by fire causing a loss of about $10,000.

FORT PAYNE, ALA.—A contract has been entered into between the Fort Payne Water Company and the Fort Wayne Light & Power Company, whereby the latter company is to operate the pumping machinery of the water company by electricity.

SANATORIUM, MISS.—The State Bond Improvement Commission, Jackson, Miss., will receive bids until Aug. 8 for the construction of a number of buildings at the Tuberculosis Sanatorium, including nurses' home, white infirmary, negro infirmary service building, recreation building, power house and laundry building. Plans and specification may be obtained on application to Bem Price, architect, Jefferson County Bank Building, Birmingham, Ala.

FAYETTEVILLE, ARK.—The plant of the West Fork Light & Power Company was recently destroyed by fire, and the citizens of West Fork and Winslow have appealed to the Fayetteville Gas & Electric Company to erect a transmission line to furnish electricity from the local plant to these two cities.

ALEXANDRIA, LA. — Bids will be received at the office of the supervising architect Treasury Department, Washington, D. C., until July 29 for furnishing wiring material in the United States public building at Alexandria, La.

SAND SPRINGS, OKLA.—H. S. Shaner contemplates the construction of a hydro-electric plant for what is to be known as the Missouri Interurban Railroad and which will cover a distance of 200 miles. The cost is estimated at $4,000,000.

TAFT, TEX.—Plans have been completed by the Taft Packing Company for the construction of a two-story fertilizer plant, 65 ft. x 115 ft. and a power house. H. S. Green, 415 Euclid Avenue, San Antonio, is architect.

Pacific and Mountain States

KELSO, WASH.—The Lewis River Hydro-Electric Power Company of Vancouver has filed application covering four power projects on the North Fork of the Lewis River above Kerns, Cowlitz County.

PORTLAND, ORE.—The Alaskan-American Paper Corporation of New York, it is reported, has applied for power rights on Orchard Lake, and plans to erect pulp and paper mills there.

PORTLAND ORE.—The Portland Railway, Light & Power Company has filed application with the state engineer for the storage of 100,000 acre-ft. of water from the Clackamas River and 600 sec.-ft. from the same stream. It is proposed to store the water in a large reservoir and divert it by means of two canals into the Oak Fork of the Clackamas River and develop approximately 58,600 hp. The cost of the project is estimated at about $3,000,000.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has been granted a permit by the Federal Power Commission to construct a diversion dam and tunnel 8 miles to the proposed King River power house, diversion dam in Roaring River and tunnel 2½ miles to power house, and a diversion dam in Rubbs Creek.

SANTA BARBARA, CAL.—The installation of ornamental lamp standards on East Carillo Street between Stata and Anacapa Streets is under consideration.

TAFT, CAL. — The installation of an ornamental lighting system in Taft is under consideration. E. M. Lynch, Los Angeles, is engineer.

BROADUS, MONT.—The city officials are considering the installation of an electric lighting plant in Broadus.

Canada

BAGOTVILLE, QUE. — The Municipal Council is considering the construction of a hydro-electric plant to cost about $30,000. L. P. Chayer is secretary.